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THE ELECTRIC LIGHTING ACT.

(PROVISIONAL ORDERS.)

As it is highly desirable that the Provisional Orders under last session's Electric Lighting Act—to which we drew attention in our columns for the 6th inst.—should be made as widely known as possible, and at the same time be commented upon in parts, we take a favourable opportunity of publishing the more important points contained in these orders, and we shall be glad to receive the views of our subscribers on any sections in which they think criticism is necessary. We will take the following as a specimen :—

PROVISIONAL ORDER

Authorising the Metropolitan (Brush) Electric Light and Power Company, Limited, to erect and maintain electric lines and works, and to supply electricity within the City of London, and the parishes of St. James and St. John, Clerkenwell, and St. Luke, in the county of Middlesex.

DESCRIPTION OF PROPOSED AREA OF SUPPLY.

The area within which electricity may be supplied under this Order (hereinafter termed "the area of supply") is the *City of London and the parishes of St. James and St. John, Clerkenwell, and St. Luke, in the county of Middlesex.* Such area is more particularly delineated on the map deposited with the Board of Trade for the purposes of this Order, in pursuance of the rules made by the Board of Trade in that behalf.

POWERS OF THE UNDERTAKERS.

Subject to the provisions of this order the undertakers shall be and they are hereby authorised to *supply electricity within the area of supply hereinbefore mentioned*, and to do all those acts and to render all those services in connection therewith as are *hereinafter referred to*, and for such purposes or any of them to exercise within the said area of supply *all the powers conferred upon them by this order*, or *conferred* or *proposed to be conferred* upon undertakers by "The Electric Lighting Act, 1882."

The powers herein referred to relate to the supply of fittings, breaking up of streets, the laying down of electric lines, erecting works, acquiring lands, &c., on much the same lines as the gas companies have hitherto followed. Reference is also made to the breaking up of *private* streets, *railways* and *tramways*, such as are included in the area of supply.

PURPOSES FOR WHICH SUPPLY TO BE GIVEN.

The purposes for which the supply of electricity under this order is *more particularly intended* are public *and private electric lighting*, but subject to the provisions of this order the undertakers may *supply electricity for all public and private purposes.*

Section 18 of the Electric Lighting Act has an important bearing on this clause. The Act states that—

The undertakers shall not be entitled to prescribe any *special form* of lamp or burner to be used by any company or person, or in any way to *control or interfere* with the *manner* in which electricity supplied by them under this Act, and any licence, order, or special Act *is used:* Provided always that no local authority, company, or person shall be at liberty to use any form of lamp or burner or to use the electricity supplied to them for any purposes, or to deal with it in any manner so as to *unduly* or *improperly interfere with the supply of electricity supplied to any other local authority, company, or person by the undertakers*, and if any dispute or difference arises between the undertakers and any local authority, company, or person entitled to be supplied with electricity under this Act, or any licence, order, or special Act, as to the matters aforesaid, such dispute or difference shall be determined by arbitration.

It will easily be seen that the option of using—on the consumer's part—any kind of lamp fancied, would considerably increase the difficulties of making a charge for the supply of electricity, and although several methods of regulating the scale of charges are proposed further on, the plan to be adopted for the present will doubtless be one of agreement between consumers and undertakers.

GENERAL DESCRIPTION OF THE PROPOSED WORKS AND OF THE NATURE AND MODE OF SUPPLY.

Subject to the provisions of this Order the supply of electricity by the undertakers within the area of supply may be given by means of *any one or more of the following systems* :—

(*a*) The "direct system," that is to say, a system in which the electricity used by each consumer is *drawn off by one of a series of parallel circuits* from a double series of continuous metallic conductors (herein termed the "positive and negative mains") in connection respectively with the positive and negative poles of the generating system. The branch conductors leading from such mains to the consumer's premises are herein termed "*service lines*," and the portions of such mains which are used for the purpose of giving origin to service lines are herein termed "*distributing mains.*"

In plainer terms, the system here mentioned is the supply of electricity direct from dynamo-electric machines. The reason that Mr. Fletcher Moulton proposes to use a series of parallel circuits from a double series of conductors, instead of connecting consumers one after the other in series, is probably due to lesser probability of any accidents in one portion of the circuit affecting the remainder ; and also to the fact that a high and dangerous electromotive force is rendered unnecessary, which will of course be a most important point to consider in extensive operations of lighting by electricity.

(*b*) The "*storage system*," that is to say, a system in which the electricity used by each consumer is drawn off by one of a series of parallel circuits from positive and negative mains, proceeding from electric reservoirs or storage batteries placed on premises belonging to the undertakers, and under their control, such reservoirs or batteries being charged from the generating system by mains, herein termed "charging mains," the supply of electricity through which charging mains may be continuous or intermittent, and need not necessarily be maintained during the hours in which the electricity is being used by the consumer.

In this method of supply, a high electromotive force can be used for charging a series of accumulators, and as the premises containing what might be termed these general reservoirs of electrical energy will belong to the undertakers, and be under their sole control, no danger to householders could well occur, as the charging mains would not go near the houses. It would certainly be advisable that the charging should be accomplished at times when the electricity is not required by the consumer, and this could generally be done during the daytime, except perhaps in foggy weather. Taking the Commercial Road as a suitable situation for this method of supplying electricity, it might be necessary to have 12 or 20 stations of accumulators on a line, each being solely under the control of the undertakers and quite independent of the consumers. Such an arrangement is certainly more desirable than the placing of secondary batteries on the consumer's premises, both as regards the safety of the latter and of those connected therewith, and for the interests of the supplying company.

(*c*) The "direct or storage system *with earth returns*," that is to say, a direct or storage system in which the earth is used instead either of the positive or negative main, or of some portion or portions thereof, or of some portion or portions of the circuits of the charging mains.

(*d*) The "*series system*," that is to say, a system in which the different consumers do not derive their supply from independent parallel circuits, but the whole current is utilised at various

points situated successively in the same circuit, and is not divided up for the purpose of utilisation into different parallel circuits which supply different consumers.

We do not imagine that section (*c*) will ever be utilised, for it is doubly safe to use two insulated wires. Taking a system using an earth return, any severe damage to the insulated conductor would probably cut out part of the whole circuit, but in the case of a return *wire* we have an extra chance of keeping our current from making earth.

Our remarks on (*a*) are apparently negatived by the method proposed in (*d*), yet if we were right in our surmise as to the reasons passing in Mr. Moulton's mind when he makes use of a series of parallel circuits, we can only conclude that he has overlooked them here, for we can see no difference between the currents produced by a dynamo-electric machine and those derived from an accumulator, other things being the same.

In fact we do not see how this arrangement is to be carried out, except perhaps to a limited extent, for as we shall afterwards show, one of the provisions for safety provided by Mr. Moulton is that the difference of potential at corresponding points of the positive and negative conductors of any distributing main or service line shall not at any time *exceed* 400 volts. It may be, however, that the "series" system is described for the sake of reference only, and left to agreement between the undertakers and consumers whether there shall be any supply on this system, it not being intended that the *public* supply shall be so.

In addition to supplying electricity on any of the systems referred to in the preceding section, the undertakers may, subject to the provisions of this order, *supply electricity by agreement*, on any other system, and may render *by agreement* any services connected with their *supply* or the *utilisation thereof* to any person and on any conditions in *all* or *any part* of the area of supply.

The supply of electricity upon any premises shall (except by agreement or as herein otherwise provided) be given at *two poles* situated thereon at a safe and convenient distance from one another in connection respectively with the positive and negative mains (or with the main and the earth, as the case may be), and the undertakers shall not, otherwise than by *agreement*, incur any liability, or be in any way responsible as to the fittings, conductors, or arrangements within the consumers' premises, whether for the utilisation of the electricity supplied or otherwise, but *their liability shall only extend to securing that the two poles are in a fit and proper condition*, and that a proper and efficient supply can be derived therefrom.

It is of course only fair that if the undertakers have no power of controlling the consumers' premises, their liabilities should only extend to the points above explained.

The undertakers may, at convenient distances along any mains situated in any street or public place within the area of supply, establish and maintain *distributing boxes* or stations for the purpose of leading off service lines and other distributing conductors, and for examining, testing, regulating, measuring, directing, or controlling the supply of electricity or its distribution, and for examining or testing the condition of the mains or other portions of the electric lines or works, or any part thereof, and for other like purposes connected with the undertaking, and may lead therefrom lines for the purpose of supplying electricity, and may place therein meters, switches, and any other suitable and proper apparatus for any of the above purposes, and may maintain and use the same. Such boxes or stations are to be in accordance with patterns approved by the Board of Trade, and shall be for the exclusive use of *the undertakers*, and under their sole control, except so far as the Board of Trade shall otherwise order.

(*To be continued.*)

A Telegraph Cable Cut.—The *Shanghai Courier* of the 23rd November says:—The Great Northern Telegraph Company's cable was found to be broken a few days ago, and, on the repairing steamer being sent out, it was discovered that the cable had been wilfully cut. We have been shown two pieces of the cable, which exhibit marks of very rough treatment. They are the ends of the broken wire, and were fished up twenty-two miles from Gutzlaff, between the North and the Side Saddles. A piece of rope had been tied to the wire, while some one on board a vessel, probably a junk, deliberately hacked at the cable with a blunt instrument, as the marks are to be seen on the strands. The company knew by tests at the time that something was being done with the cable.

ELECTRICAL ACCUMULATORS.

THE Electrical Power Storage Company recently notified that on and after the 1st January the company would be prepared to supply Accumulators to the public under certain conditions. That this is a step in the right direction no one will deny, and we wish the company success in its spirited enterprise.

We believe that this is the first and only source from whence the public are enabled to actually purchase any secondary batteries for whatever purposes they may require them. When the Faure Accumulator was first brought before the notice of the world great things were expected of it, but, *practically*, this nine days' wonder ended in disappointment. We do not know of any person who was successful enough to purchase a few Faure cells, although we and others known to us have used them on loan. Now that arrangements have been entered into by the possessors of the Faure and Sellon-Volckmar inventions, the above-mentioned company comes forward to supply the Faure-Sellon-Volckmar Accumulators, and also we notice the Sellon-Swan secondary battery.

The conditions under which the public are entitled to use these requirements for electric lighting and other purposes, seem to show that technical supervision is required for their successful operation.

For instance, the company must have the right to inspect periodically the manner in which the accumulators are being used, and if necessary, to require an alteration in the manner of such use.

If the directions and requirements of the company are duly carried out, a guarantee will be given by them that the accumulators will be kept in good and perfect condition for a period of not less than one year.

This stipulation is made owing to the prevalent inexperience in the employment of electrical accumulators, and to prevent reports being circulated to the prejudice of the accumulator founded on unskilful or improper treatment by purchasers.

The guarantee, however, at present applies to London and its vicinity only.

According to the company's circular the cells at present manufactured are of three sizes, equal respectively to one, two, and five electrical horse-power, but where necessary other sizes would be made to order. Why should the company speak of *electrical* horse-power to the general public?

The consumption of one horse-power means the same thing whether the energy is expended in an electric lamp or in a steam-engine. The use of the above expression has often been, and will probably still be, very misleading. Many people believe that *electrical* horse-power is something quite different to what they have been accustomed to understand by horse-power, and the usual method of stating that "so many incandescence lamps are obtained per electrical horse-power" would be much more satisfactorily expressed by saying "so many lamps are obtained per actual horse-power expended *in the lamps*."

The following instructions are issued by the company for the guidance of those using the accumulators:—

The Faure-Sellon-Volckmar accumulator represents the latest and most perfect form of secondary battery or electrical store.

In all the cells the positive pole is marked with red and the negative with black colour.

The E. M. F. of each cell is 2·15 volts, and remains practically constant up to the economical point of discharge. If the discharge is continued beyond this point one or more cells must be added to the circuit to maintain the E. M. F.

Where the accumulator is properly used, as hereafter described, the effective return is 90 per cent. of the electrical energy stored.*

Great care must be taken that, before the dynamo machine is connected with the accumulator, the poles of the dynamo are well ascertained. This may be easily done by making a simple voltmeter with two plates of lead put into a glass of water with a few drops of sulphuric acid. The positive pole is that of which the lead becomes immediately peroxidised or black. This must be coupled to the positive or red pole of the accumulator.

The cells must be coupled, the positive to the adjoining negative and so on, the red and black poles being coupled the one to the other. The last cell of the accumulator must be coupled, the black pole to the negative pole of the dynamo.

It is suggested that all superintendents should, from time to time, personally inspect and test the couplings, as the great inconvenience

* It is not stated what percentage of the energy used in charging these cells is obtained.—EDS. ELEC. REV.

arising from a little carelessness on the part of a workman may be thus avoided.

It is advisable to insert an ammeter with a shunt between the accumulator and the circuit, so as to measure the current of the dynamo, and also what is taken out of the battery. The company supply ammeters for this purpose.

To bring the accumulator to its normal state of activity, it is desirable to charge and discharge twice at least in order to get rid of the sulphate of lead which forms on the plates when the accumulator is allowed to remain dormant. This also applies to cases where the accumulator has not been used for some time.

Special care must be taken to have the accumulators well insulated, as any moisture being permitted to remain between the cells occasions a considerable loss of E. M. F. on the whole battery.

Before switching the accumulator on to the dynamo, the latter should be going at its full rate of speed, otherwise its E. M. F. would be less than that of the accumulator, which in that case would overpower the dynamo and reverse the current.

Care must be taken to keep the plates entirely submerged.

To always maintain the same E. M. F., 25 per cent. of electrical energy which the accumulator is capable of receiving must be allowed to remain, and 75 per cent. may be withdrawn. For example, an accumulator composed of one H. P. cells should at first be charged with 400 ampères of current; then when 300 have been withdrawn, 330 (300?) should be put in again. This permits a further 300 ampères to be taken out, still leaving 100 ampères in the accumulator. The same proportion applies to the various sizes.

The rates of economical charge and discharge of the respective sizes are as follows:—

	Charge.	Discharge.	
One H. P. cells	20—25	30—40	ampères.
Two ,, ,, ...	40—50	60—75	,,
Five ,, ,, ...	100—125	150—175	,,

The proper number of cells to form an accumulator is readily ascertained. When the E. M. F. needed to overcome the resistance of a lamp is known, it must be divided by 2·15, and the product shows the requisite number of cells to illuminate the lamps.

It is perfectly immaterial, so far as the accumulators are concerned, with what continuous current dynamo (wound in shunt) it is charged or with what incandescent lamp it is employed. Arc lamps, with proper adjustments, may also be maintained by accumulators.

So long as incandescent lamps are directly dependent on machinery any fluctuations in speed of the motor (and with gas-engines each stroke can be observed) produces a corresponding fluctuation in the steadiness of the light, and there is also the liability that a sudden excess of current may destroy the filament, but accumulators entirely overcome these defects.

The extent of plant required for an electric light installation is very materially diminished by the employment of accumulators. For instance, an installation of 1,000 incandescent lamps burning for an average of five hours daily would require a steam-engine of 100 indicated H. P. and a dynamo of proportionate high power and cost, but with accumulators a steam-engine may be worked for 24 hours daily, as during the five hours lighting it will produce part of the current required; consequently the 100 H. P. steam-engine and dynamo may be reduced to 25 H. P.

In addition to this there is the invaluable protection against inconvenience from accident, disturbances such as the slipping of a belt or the loosening of a screw, which, although of the most trifling nature, may produce immediate darkness and confusion.

Again, from an economical and commercial point of view, accumulators possess the enormous advantage of only yielding up the quantity of electricity actually consumed by the lamps alight at the moment; whereas, when lighting is done direct from a dynamo, if part of the lamps are put out an equivalent resistance must be inserted in order to prevent the breakage of the remaining lamps. Notwithstanding, however, the extinction of, say, 90 per cent. of the lamps, the expenditure on the motive-power would remain virtually the same as when the whole of the lamps were alight.

The following table will be found of interest.

E. M. F. of Lamp in Volts.	No. of cells composing Accumulator.	Rate of Discharge in Ampères.	Maximum charging capacity in Ampères.	Price of Accumulator. Sellon-Swan. £	s.	d.	Faure-Sellon-Volckmar. £	s.	d.
45	22 One E. H. P.	30—40	400	110	0	0	79	4	0
45	22 Two ,,	60—80	800	220	0	0	158	8	0
45	22 Five ,,	150—175	2,000	550	0	0	396	0	0
50	25 One ,,	30—40	400	125	0	0	90	0	0
50	25 Two ,,	60—80	800	250	0	0	180	0	0
50	25 Five ,,	150—175	2,000	625	0	0	450	0	0
60	30 One ,,	30—40	400	150	0	0	108	0	0
60	30 Two ,,	60—80	800	300	0	0	216	0	0
60	30 Five ,,	150—175	2,000	750	0	0	540	0	0
100	50 One ,,	30—40	400	250	0	0	180	0	0
100	50 Two ,,	60—80	800	500	0	0	360	0	0
100	50 Five ,,	150—175	2,000	1,250	0	0	900	0	0
110	55 One ,,	30—40	400	275	0	0	198	0	0
110	55 Two ,,	60—80	800	550	0	0	396	0	0
110	55 Five ,,	150—175	2,000	1,375	0	0	990	0	0

The last paragraph in the manual of instructions is not altogether correct, as there are dynamo-electric machines at present constructed which automatically regulate themselves to the amount of work to be performed, the "Dandeu-Chertemps," for example.

The action of the Electrical Power Storage Company is one of the most important which has yet been resolved upon, and will doubtless have a considerable effect upon the future of electric lighting.

It cannot be denied that systems in which accumulators are thought unnecessary, are liable at some time or other to stoppages, which may, however, be but brief, and although secondary batteries have not yet shown themselves in extensive practice to be relied upon one cannot but think that in due time an idea containing such great promise will eventually be successful. Inventors should now strive after perfecting the *lasting* capabilities of accumulators, for it is in this respect that failure has hitherto been the result of all experiments with secondary batteries. The Electrical Power Storage Company must possess great faith in their appliances to guarantee their good condition for a year, even when skilfully supervised; and the results of the company's undertaking will be looked forward to with the greatest interest not only by electricians, but by the general public, to whom the question of lighting generally by electricity is now the all-absorbing topic of the day.

We may add that the company will tender for the erection of complete installations, comprising steam, caloric or gas-engines, dynamos, accumulators, lamps, conductors, &c., &c.

Where one installation comprises more than 2,000 lamps the company will contract to erect and maintain it at a fixed annual charge.

The system can be inspected at the company's offices, and the accumulators may be also seen in operation daily at the offices of the Eastern Electric Light and Power Company and the Indian and Oriental Electrical Storage and Works Company.

INTERNATIONAL ELECTRICAL EXHIBITION IN VIENNA.

IT has now been definitely decided that the International Exhibition, which was proposed to be held in Vienna last year and postponed on account of a similar exhibition taking place at Munich, will be carried out this year, and will continue from August 1st to October 31st. A general commission having been formed, a managing committee has been appointed to arrange and manage all matters relative to the exhibition. Applications for space must be in the hands of this committee (the address of which is Wallfischgasse, 9, Vienna) before March 1st, and exhibits in position and arranged by July 15th. In this country application-forms can be had of the Austro-Hungarian Consul. The exhibits to be admitted are divided, according to the principle which they embody, into the following classes:—

Class I. Magneto-electric and dynamo-electric machines.

Class II. Galvanic cells, batteries, accumulators, thermo-electric piles.

Class III. Scientifical apparatus, instruments for electrical measurements, electro-static apparatus.

Class IV. Telegraphs.

Class V. Telephones, microphones, photophones.

Class VI. Electric lighting.

Class VII. Transmission of power.

Class VIII. Cables, wires, conductors.

Class IX. Application of electricity to chemistry and metallurgy.

Class X. Application of electricity to war.

Class XI. Railroad electrical appliances.

Class XII. Application of electricity to mining, navigation, and agriculture.

Class XIII. Electro-medical apparatus.

Class XIV. Application of electricity to automatic registration, to horology, meteorology, astronomy, and geodesy.

Class XV. Miscellaneous.

Class XVI. Application of electricity to domestic use, to art-industry and decoration.

Class XVII. Application of machinery to electrical industry; boilers, steam, gas, and hydraulic engines.

Class XVIII. Historical collections. Methods of instruction, bibliography.

The exhibitors will pay no rent for the space allotted to them, the general commission undertaking, at its own expense, the arrangement and general decoration of the building. The exhibitors, however, must bear the cost of the installation and decoration of their own exhibits, and the plans of these must be submitted to, and approved of by, the managing committee. They must also provide against every danger to the public and to the buildings in the installation and working of their exhibits. Motive-power will be supplied to the exhibitors who require it at 5d. per hour; and that required for the purposes of the scientific commission will be supplied free. No prizes will be awarded by a jury. During the exhibition a technical and scientific commission will be organised in co-operation with the exhibitors, in order to carry out electrical measurements and other scientific investigations with a view to testify results. The general commission will make arrangements for scientific and technical lectures. A complete catalogue will be drawn up and published at the opening of the exhibition.

WRIGHT AND MACKIE'S MECHANICAL GLASS-BLOWER.

IN one of our "Notes" in the ELECTRICAL REVIEW for December 16th, 1882, we briefly mentioned an ingenious and most useful application of machinery to the process of glass-blowing for all purposes, but at present more particularly laid out for the formation of the globes complete for incandescence electric lamps. Amongst the numerous disadvantages hitherto existing in the manufacture, on a commercial basis, of incandescence lamps have been the scarcity of skilled manual labour and the high rate of wages the few command.

In the face of these facts it was practically impossible to produce a supply to cope with the demand, and the prices therefore ranged high.

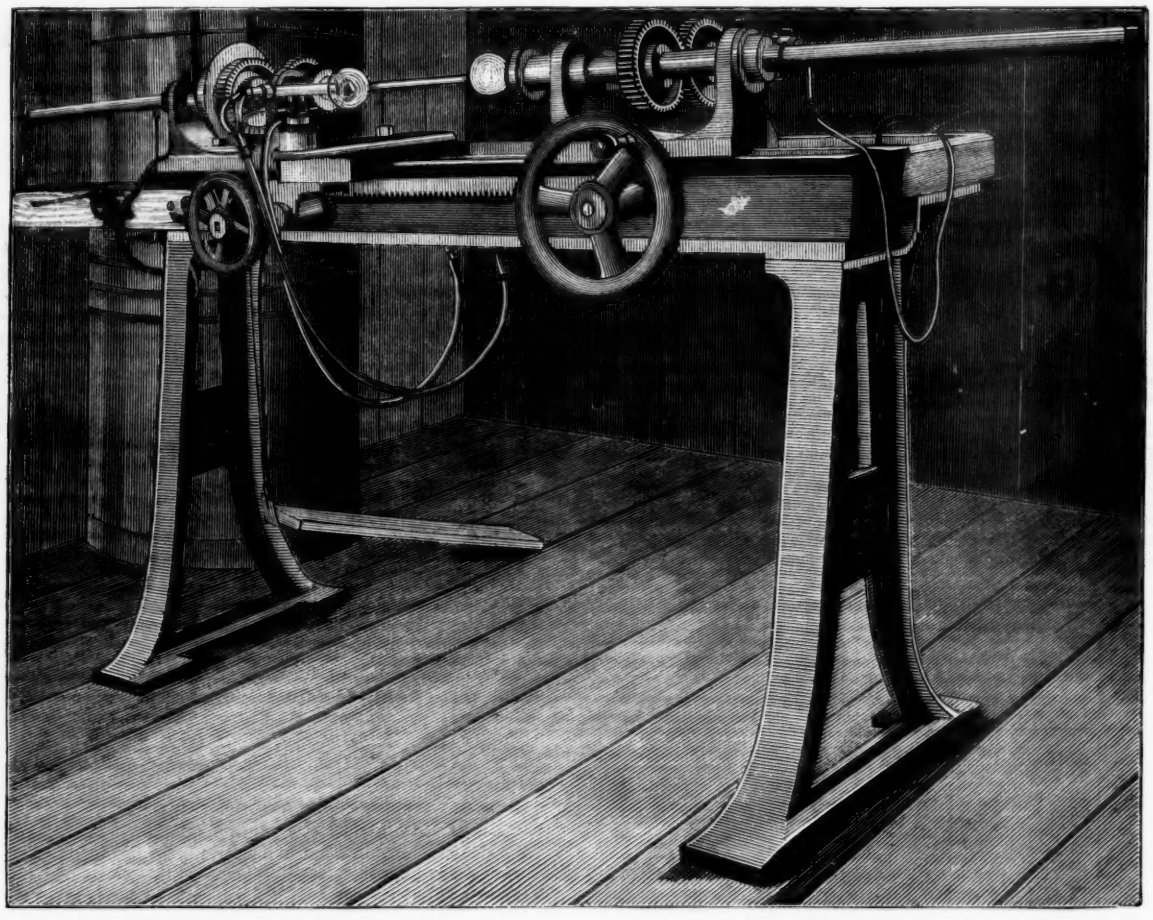
Anything tending to cheapen the cost of production and to multiply the rate of manufacture should be hailed with satisfaction by electric light companies generally.

One of the great difficulties in hand glass-blowing is the uncertain and irregular rotation of the glass tube which the operator is manipulating and the difficulty of bringing the flame of the blowpipe to bear regularly on all parts of the tube during rotation. There are other drawbacks which will readily suggest themselves to those conversant with the subject, and the introduction of machinery will enable those parts of glass-blowing operations which have hitherto been of an uncertain and unsatisfactory nature to be performed with mathematical accuracy.

The machine which we are about to describe is shown in perspective in the figure, and is specially devised for incandescence-lamp work.

In general appearance it resembles an ordinary back-gear lathe, with this difference, that it is supplied with two head-stocks fitted with hollow mandrils. The mandrils are caused to rotate synchronously by means of geared wheels and a back countershaft.

The left hand, or main head stock, is fixed on the bed of the apparatus, the right hand one being movable and capable of traversing the bed. The mandrils are fitted with suitable chucks for holding the glass tube to be operated upon, and supplied with air pressure internally, which is controlled by a suitable valve, actuated by the treadle. The operation of blowing a bulb, or globe, is as follows:—The glass tube is inserted at both ends in the chucks, which hold



it tightly, and in a diametrical line with the two mandrils. The two ends of the tube project through india-rubber, or other flexible washers fitted in the chucks, thus making an air-tight connection between the tube and the mandrils. The flame of a compound blowpipe, which is fitted on the bed of the machine, is caused to play upon the tube, and when the necessary heat is attained the air pressure is admitted inside the tube through the mandril, and in conjunction with the motion of the right hand, or movable

head stock, will produce any shaped bulb that the manipulator desires.

By this means one or several globes may be made at the same time. We may add here that the compressed air for the supply of the blowpipes, and for expanding the bulbs, is contained in a reservoir seen behind the machine, into which it is forced by means of bellows or other apparatus, actuated by steam-power. The reason of this is that were the bellows alone employed, an intermittent, or pulsating, pressure of air would be the result.

The advantages, amongst others, of Wright and Mackie's method of glass-blowing over manual labour may be enumerated thus :—

The manipulation of the glass is done mechanically and truly, leaving the attendant's hands entirely free for operating the machine.

The globes are blown in such a position as to enable a clear view of all parts of the apparatus to be obtained without distortion, and obviating, by regular rotation, the necessity of removing the tube from the action of the flame and any risk of fracture.

It will enable the operator to produce globes of the same shape and size more nearly than by hand.

The globes are manufactured of a regular thickness throughout, and are free from any defects generally inherent in those blown from the mouth.

It is estimated that one of these machines, operated by a youth of ordinary intelligence, is capable of producing 500 bulbs complete, with pump stems, per day of 10 hours.

A skilled blower in the same time could only turn out, under the most favourable conditions, one-fifth of this amount.

When it is considered that the mechanical blower is, or may be, looked after by a youth receiving, say, 15s. per week ; and, on the other hand, a skilled glass-blower can easily make six times the above sum, but can only turn out one-fifth of the work that the machine will do, the immense saving in the manufacture of globes for incandescence lamps, due to the substitution of mechanical for manual labour, becomes at once apparent.

We hope to illustrate, in our next issue, another machine of Messrs. Wright and Mackie's design, specially adapted for chemical and physical laboratories and for philosophical instrument makers. At the same time we shall describe fully the chuck used in the present machine for holding the ends of the glass tube, in which will be found some novel points ; and also the compound blowpipe already referred to.

THE ELPHINSTONE-VINCENT DYNAMO-ELECTRIC MACHINE.

IN the ELECTRICAL REVIEW for December 2nd, 1882, was given a short general description of this dynamo-electric machine, which is manufactured by the well-known firm of Paterson and Cooper, of St. Paul's Works, Little Britain, E.C. The article was illustrated with a large perspective view of the machine. We can now bring before our readers some further details concerning this invention which will

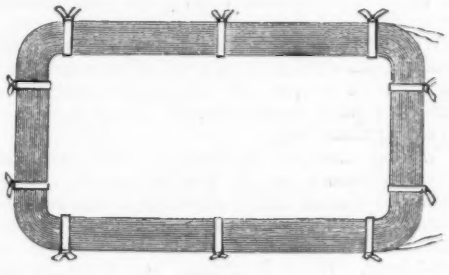


FIG. 1

doubtless be found of interest. It was mentioned that the armature coils formed flat hollow parallelograms of double wire and that they were laid on the outside surface of the armature drum overlapping each other. The construction of these coils will be better understood by reference to fig. 1. These hanks of wire were formerly bent over the armature drum at their ends, but this has now been lengthened and the coils can be laid on without bending over. The genera arrangement of the coils is similar to that shown in ou "Abstract of Specifications" columns for April 1st, 1881 the overlapping ridges of the hanks of wire being *outside* th plane of the field magnets.

In these machines it will be seen that the coils pass between the faces of the field magnets, which are so clos together as to form very powerful magnetic fields. In the armature there are no iron cores nor the necessity for them, and therefore the speed at which it can be revolved is practically only limited by the strength of the armature. As a matter of fact, however, Messrs. Paterson and Cooper have not cared to run the machines at more than 1,000 revolutions per minute, but we understand that a modification has been introduced which it is hoped will enable a considerably higher speed to be attained.

We have been favoured with the following particulars of experiments with one of the shunt dynamos. The speed, we are informed, was taken from the countershafting from which the machine was being driven, so that a little allowance must, therefore, be made for the possible slipping of the belt. The external resistance used was acidulated water with lead plates as electrodes, as shown in fig. 2. T, T repre-

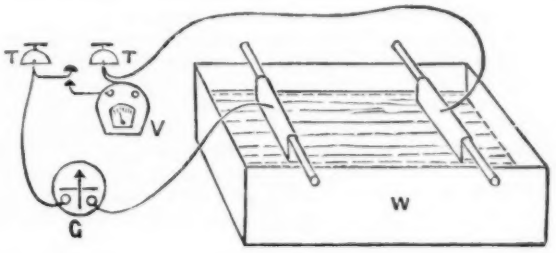


FIG. 2.

sent the terminals of the machine ; V, a voltmeter ; G, a galvanometer for large currents ; and W the water resistance.

The resistance of the armature is 0·0374 ohms, and the field magnets if in series have a resistance of 17, and if parallel of 4·25 ohms respectively.

As we mentioned in our former notice of this machine, terminals are provided for conveniently making the necessary connections.

When the field magnets are joined up so as to have a resistance of 4·25 ohms, with an external resistance of ·39, the maximum electrical efficiency is 82·9, and when having a resistance of 17 ohms, and an external resistance of ·799, the maximum electrical efficiency is 91 per cent.

Field magnets.	Ampères.	Volts.	Ohms.	Revolutions per minute.
Dec. 11th, 1882.				
4·25ω	160	72·	·45	800
,,	160	76·5	·478	850
,,	155	74·25	·479	Not taken
,,	190	68·85	·362	,,
,,	180	72·	·4	868
,,	190	74·25	·39	Not taken
,,	200	74·25	·371	900
,,	170	78·	·458	880
,,	175	90·	·514	880
,,	190	90·	·473	900
Dec. 12th., 4·25ω	180	76·5	·425	900
,,	190 used 2-20 c.p. Swan lamps in series = 288 lamps taking 1·32a each			855
Dec. 13th. 17ω	100 used 2-20 c.p. Swan lamps in series = 152 lamps taking 1·32a each			1,050

The advantages claimed for these machines are numerous :

1. The small amount of waste wire.

2. The ease with which machines having very different electromotive forces can be built on the same framework. The coils being removable, and the magnets capable of being so coupled as to offer very different amounts of resistance, at short notice machines can be supplied having any E. M. F.

between 46 and 500 volts. A faulty coil can also be replaced in a few hours.

3. The separate circuits enable the inventors to have an armature with a very low resistance, although comparatively thin wire be used. This is peculiar to this machine. As also no magnetisation and demagnetisation of any part occurs, the inventors maintain that with their mode of building machines a higher degree of efficiency is attainable than by any other system. An efficiency of 82·9 per cent. to 91·0 per cent. can be obtained, according to whether it is desired to attain the best return for H. P. consumed, or maximum current without considering H. P. used.

4. The amount of power absorbed by friction is very small. The amount of current used to excite the field magnets may be varied while working, so that the efficiency of the machine is no question of speculation, but is absolutely demonstrable.

(The inventors express their opinion very strongly that such a degree of efficiency as 90 per cent. is absolutely unattainable in any machine in which the armature becomes even moderately hot.)

With 190 to 200 ampères of current the armature is barely perceptibly warmed. A question of mechanical construction has prevented the machines of which the tests are here given being driven at the desired speed of 1,100 or 1,200, which will be attained with some now constructing, when the maximum results will be increased 50 per cent.

The Elphinstone-Vincent machines can be built of a size to light a *whole town* from a single machine, since its parts are capable of almost indefinite multiplication.

The armature has 18 sections wound with double wire, making 36 coils. The resistance of armature between brushes, ·0374 ohms. Six brushes, we believe, are connected up, so as to form practically but two, as in ordinary cases. Resistance of a single outside arm of the field magnets, 1·93 ohms. Resistance of single inside arm, ·9 ohms. Total weight of machine, about 26 cwt.

The experiments made do not appear to us of any great value, or even to be reliable, where a water resistance enters into the matter, and we therefore cannot express a decided opinion as to the efficiency of the Elphinstone-Vincent machine at present under the conditions stated.

We shall, therefore, await the results of the exhaustive tests which, no doubt, the manufacturers of these machines will shortly be able to carry out with such resources at their command. We have seen these machines in course of construction, and they are made with that regard to electrical and mechanical finish to be expected from Messrs. Paterson and Cooper, who, we believe, are also constructing machines of other inventors, and whose extensive premises at Pownall Road, Dalston, appear to be well adapted for this class of work.

Since writing the above we have received from Mr. Charles W. Vincent, on behalf of Lord Elphinstone and himself, the following particulars of experiments made with their machine at Messrs. Unwin's, the "Gresham Press," Blackfriars, on Monday, which demonstrate the possibility, with a machine running at erratic speed, of keeping up a constant electromotive force.

The engine was driving the whole of the printing machinery as well as the dynamo-electric machine. Steam was low, and at the close of the experiment water was pumping into the boiler. Weston arc lamps, two in series, were on branches from the main circuit, but the current through these was not taken into account, being nominally 30-volt lamps. They burnt exceedingly well with 31·5 volts, *i.e.*, 63 volts through the series of two. The lamps were switched in and out at pleasure. The experiments were brought to an end when no current was left in the main circuit, with which to steady the E. M. F. The speed of the machine was from barely 500 up to 1,000 revolutions per minute. In the latter case the machine was doing no external work. The readings before any current was taken off the main to the branches were as follows:—

MAIN CIRCUIT.

Ampères.	Volts between terminals.
135	90
189	72
171	84
157·5	72
162	78
198	66

E. M. F. kept steady and branches opened:—

MAIN.

Ampères.	Volts.
135	63
135	61·5
112·5	63
117	63
63	61·5
0	63

It would be rather hazardous to attempt to work incandescent lamps with fine filaments under these conditions, but lamps of the coarser sort would work fairly well, in parallel with arc lamps, with somewhat careful manipulation. It need hardly be said that the 300 to 400 Swan lamps, with which it is proposed to light Messrs. Unwin's premises, will not be exposed to such trying ordeals; and that in actual working the speed of the machines will be kept tolerably uniform. With a series machine, 12 Weston arc lamps, 4 in series, arranged in 3 parallels, were kept steadily running, the E. M. F. between the terminals being 150 volts.

THE ELECTRIC LIGHTING OF FORGES AND WORKSHOPS AT ST. DENIS.

THE system of illumination of which we are about to give a description is characterised by this special feature, that with an engine established in the workshops, and from which only about 10 H. P. can be obtained continually, and with a single continuous current dynamo capable only of absorbing this 10 H. P., it is possible to produce an illumination which, when all the lights actually installed are in use, represents a power of more than 15 H. P.; and, moreover, this result could greatly be exceeded, if it were necessary to increase the illumination, without changing either the power of the motor or that of the generator.

This problem, the solution of which would have been very embarrassing only a few years ago, is now very simple, owing to the employment of accumulators.

The buildings to be lighted consist of two large sheds placed at a distance asunder of 200 mètres. They are devoted to the construction of railway carriages. In the first is found the machinery intended for working the wood and iron which enter into the construction of these carriages. The engine, which has always a superfluous motive power of about 10 H. P., is placed near this building, the illumination of which is effected by ten arc lamps on the Weston system in series. The second building is intended for the painting, drying, and finishing of the carriages, which are arranged upon several rows of parallel rails, and it is lighted by twenty-four incandescent lamps on the Maxim system. This illumination presents some special features to which we shall shortly return. We will now consider the general economy of the system. In the daytime for about four hours, the Weston machine charges accumulators placed in the painting works; when the night comes, the charging of the accumulators is stopped, and they are discharged through the incandescent lamps, and the machine is put in circuit with the Weston arc lamps.

The illustrations will show the arrangements adopted to make sure of the working of the system. Fig. 1 represents the commutator-board placed near the engine and Weston machine in the first building; fig. 2, the accumulators and the arrangement for regulating the discharge.

The Weston machine is well known to many of the readers of the ELECTRICAL REVIEW; we need not therefore mention it further now, or the Maxim incandescence lamps and corrugated plate accumulators of M. de Kabath which serve to supply these lamps.

The Weston machine produces a continuous current, having its inductors in the general circuit. When it supplies the 10 Weston lamps, for which it was more especially constructed, it furnishes a current of about 20 ampères, an electromotive force of 250 volts, and it consumes nearly 10 horse-power. When it charges the accumulators, arranged in two groups in quantity of forty elements in tension—80 elements in all—it is necessary to introduce into the circuit resistances intended to weaken the current; this is because the electromotive force of the machine is considerable, and would allow of placing more than forty elements in tension. The introduction of these resistances into the circuit really produces a certain loss of work use-

lessly expended in heating these resistances, but this waste, easily prevented by adopting another grouping of the elements, is only of secondary importance, since the power is superfluous and comparatively low-priced.

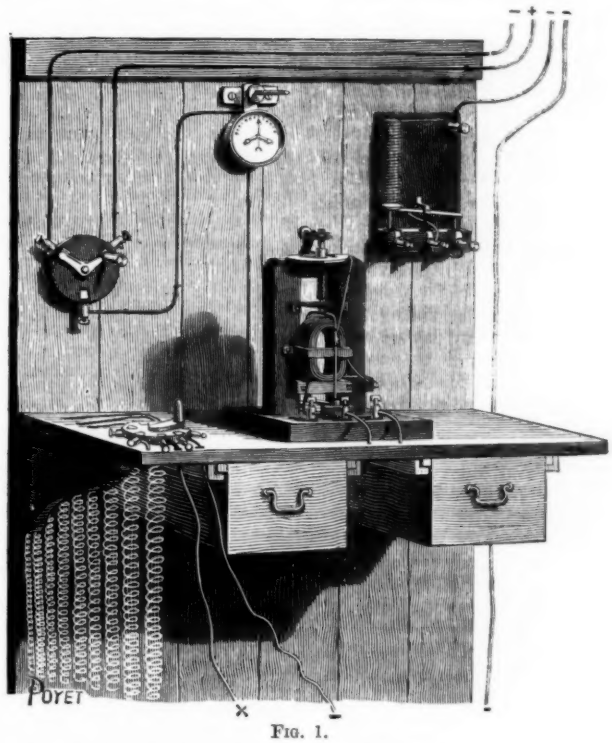


FIG. 1.

The resistance introduced into the circuit during the charge is regulated by the commutator. A Siemens and Halske electro-dynamometer, placed in the discharge circuit, makes known constantly the intensity of this current, which varies between 20 and 22 ampères, or 10 to 11 ampères per series of accumulators, and a current indicator always shows the *direction*. To avoid any reversing of the current in the generator, which would occur in case of stoppage or too great slackening of speed, an *automatic "cut-off"* is arranged in the circuit, which breaks the circuit when the current is on the point of changing its direction. This "cut-off," shown upon the right of fig. 1, consists of an upright electro-magnet, with one branch traversed by the current. This electro-magnet keeps raised a small horizontal lever, at the end of which is a small iron disc, which it attracts; the lever falls by the weight of the disc when the current ceases, and breaks the circuit. A two-way commutator, placed on the left, allows of sending at will the current into the accumulators or into the Weston lamps.

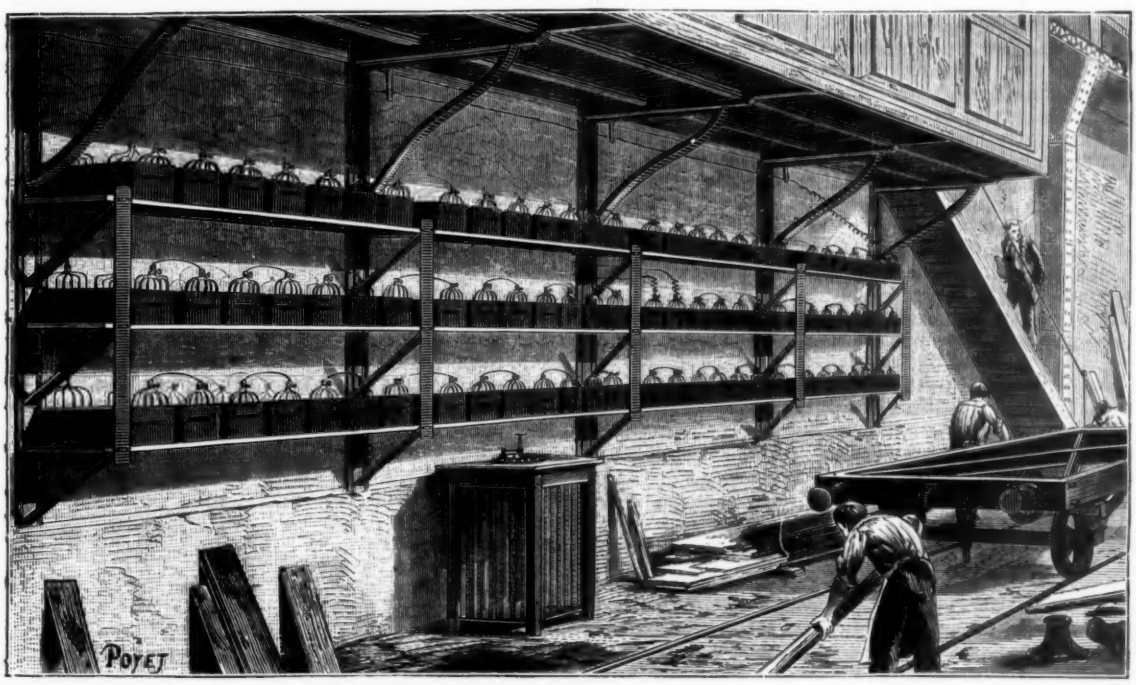


FIG. 2.

Fig. 2 represents the 80 accumulators, disposed upon three shelves, and in two series of 40 elements each.

The 24 lamps are connected in derivation, and work with

a mean current of 1·6 ampères, or about 40 ampères for the 24 lamps. Each series of accumulators furnishes, therefore, a current of 20 ampères, that is to say, 20 coulombs per second. The lamps require only 50 volts difference of potential, and as the 40 accumulators in tension represent, at the commencement of the discharge, more than 80 volts, and this discharge decreases constantly, at the moment of lighting a certain resistance is introduced into the circuit of the accumulators, and this resistance is gradually diminished by manipulating a round commutator, with 14 variations, which allows of changing it by insensible degrees.

All these resistances are formed of platinum wire rolled in long spirals and exposed to the open air to facilitate their cooling. This produces a further waste of power, which the engineer to M. de Kabath (M. Charles Farquhar) willingly admits, in consideration of the excess of disposable power and the simplicity of manipulation which the arrangement adopted presents.

The duration of the illumination does not actually exceed an hour and a quarter, but it increases every day with the formation of the elements, and M. Farquhar hopes soon to attain a total duration of three hours with the 80 accumulators actually installed, and this notwithstanding the waste produced by the regulating resistances.

The charge representing 20 ampères for four hours, and the discharge 40 ampéres during one hour and a quarter, one only receives during the discharge 3-5ths of the quantity of electricity expended for the charge, but this is because, on the one hand, the lighting is stopped before the accumulators are completely discharged, and, on the other hand, the quantity of electricity supplied during the period of charging exceeds, perhaps, that which the accumulators should receive usefully.

The mode of suspension of the lamps established in the finishing shop is ingenious and interesting. The shed in which the carriages are placed is of great size, but work is not carried on at all parts at once, since it comprises several successive phases separated by intervals of time more or less prolonged. It is therefore necessary to be able to easily remove the lamps from one point to another, according to the requirements of the work without danger of entangling the wires which convey the current to them. This inconvenience has been easily avoided by stretching two uncovered parallel copper wires, at a distance of about a foot between each row of carriages, and at a height of 5 to 6 mètres.

These wires serve at once for conductors and supports. The lamps are suspended from a hollow iron stem, into which pass two conductors connected with two horizontal copper arms insulated from each other, and which give to the lamp the appearance of a very elongated T. These two arms run upon the stretched wires, support the lamp, and conduct the current to it. One can thus easily bring the lamps to the point desired, by sliding them backward or forward upon the rods which support them.

The lighting of the forges and workshops at St. Denis presents, therefore, on the whole, a series of interesting and ingenious dispositions worthy of being noticed, and if all are not equally to be recommended, some might be advantageously utilised under similar circumstances.

Lecture: The Advance of Electricity.—Mr. W. H. Preece, F.R.S., the chief electrician of the Postal Telegraph Department, delivered a lecture on this subject in the Corn Exchange, Basingstoke, on Friday week. The exchange was beautifully lighted for the occasion by electricity, a complete small lighting-plant having been fixed in position for the purpose. Mr. Preece spoke of the enormous strides which had been made in the various adaptations of electricity, and made experiments for the purpose of exhibiting the principles on which the "incandescent" and the "arc" systems of electric lighting were based. One advantage of the electric light over gas, he said, was that it consumed no air. The atmosphere remained the same. Though the light was produced by heat, it produced none; and large employers of labour found that their men could work far more comfortably under the electric light than by gas. The lecturer also referred to the extensive uses now made of the telegraph, and the telephone and other electric apparatus, and said that electricity was becoming a thing of everyday life, and the time was near at hand when it would be used to an extent that few at this moment could comprehend.

TO CORRESPONDENTS.

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Letters, &c., for the "Correspondence" columns should arrive not later than Tuesday morning if they are desired to appear in the following number, such communications to be addressed to the "Editors," ELECTRICAL REVIEW, 22, Paternoster Row, London, E.C.

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CORRESPONDENCE.

Reviews.

On reading your Review on "Useful Rules and Tables relating to Mensuration, &c., &c. With Appendix, containing Tables, Tests, and Formula for the use of Electrical Engineers. By Andrew Jamieson, C.E., F.R.S.E.," I thought, if it is possible for you to do so, you could do good service to your readers by publishing the "Appendix" in your columns. The whole book is far too dear for electricians, considering the amount of matter that is likely to be useful to them, especially to those who already possess a previous edition without the "Appendix."

I am anxiously looking forward to what I took to be a promised review of (promise made page 450, December 9th, 1882,) "Electric Illumination."—By James Dredge as Editor, and other Authors. I hope you will soon review the above work, as such reviews as yours form valuable guides to purchasers of limited means, surrounded by editions of various qualities. Of course the names of the authors ought to be a sufficient guarantee; but then the price is 30s.

Again, with respect to your answer to Mr. E. C. Rimington, in yesterday's issue, *I hope you will often have occasion* "to refer to Mr. Rimington's," or any other person's papers when *students* are liable to be misled, for I think you will agree with me that it is a serious matter for students when papers written for their benefit are not strictly correct.

I appreciate very much the papers referred to and am thankful to Mr. Rimington for his share in the same, but I do sincerely think that criticism should be given and received with the utmost good feeling, and in the most friendly manner, especially when students are concerned and *correctness* is the aim.

I also thank you for the references to the papers referred to, believing that students will be gainers.

Yours faithfully,

James Grundy.

68, Woodhouse Lane, Wigan,
January 13*th*, 1883.

[We are afraid we cannot comply with our Correspondent's wish expressed in his first paragraph. Concerning the second, however, we certainly advise an investment in "Electric Illumination," being assured that satisfaction will be the result.—EDS. ELEC. REV.]

Electro-motors.

Permit me, in answer to Mr. Newton, to say that I do not think the analogy between his steam-engine and a battery to be correct. When the load is taken off his motor the current falls, and in so doing affects the strength of the field magnets of his generating machine. The attractions in the latter become less, and as there is less resistance to overcome, the engine has a tendency to move quicker. If it was permitted to do so an equilibrium would be re-established, the electrical work again corresponding to the pressure of steam; but the moment the engine commences to move quicker, the supply of steam is diminished by its governor, and the whole system quickly approaches a state in which little more electricity is generated than what is necessary to overcome the friction of the motor. If the field magnets of his generating machine were excited separately the engine would behave differently.

I have made some tests with a battery and a Griscom motor, with a view to ascertain what weight of zinc is consumed when the motor runs free, and when it is stopped. The motor, when running free, reduced the current to about one-tenth. It was set running for half an hour, and the zinc carefully weighed before and after. It was then kept at rest for the same space of time, and the zinc weighed again. Owing, no doubt, to the uncertainty of action in the battery, the results differed considerably. In one instance the zinc consumed was five-sixths of the amount consumed when at rest, and taking the mean of the four double tests that were made, the proportion was about two-thirds. There is, therefore, certainly less energy generated when the motor runs free, and something must take place within the motor which causes this shortcoming. I was partly prepared for this after considering that besides the principal electrical action (viz., that resulting from the changes of polarity in the armature), there are a number of minor actions from other causes. The poles of the armature passing the field coils, and the coils of the armature passing the field poles as well as the field coils, it is extremely difficult to follow up and to apply Lenz's law to all these; I have tried it and found it a hopeless task; but it is almost certain that some, or perhaps all, of these minor actions interfere with the principal one, and this interference will be all the more manifest at higher speeds, as these counteractions increase with the speed, whereas the principal action does not increase in the same proportion, owing to the fact that the magnetisation and demagnetisation is less perfect than what it is at lower speeds.

On the whole, however, I think it will be seen that the above results favour the suggestions I have made.

Moritz Immisch.

119, Toriano Avenue, N.W.

I regret that Mr. Immisch does not see that the challenge which he throws down in the concluding lines of his letter (p. 15) is one which it is useless for me to respond to; for if the work done forty years ago by Faraday and by Joule, by Favre and by Jacobi, does not convince him of the points against which he contends, no amount of evidence that I could pile up will be of avail. He surely does not expect me to prove again old and well-proven and accepted scientific facts! And if he is unable in calmness to read the explanations which, with some care and pains, I put forth for his benefit a fortnight ago, I cannot expect from him a dispassionate acceptance of further experimental results. The three points established long ago were these:—By Faraday, that the useful consumption of zinc in the battery was proportionate to the strength of the current; by Joule and by Favre, that the energy of the current so produced, when not absorbed in a motor (or other work-producing instrument—voltameter, accumulator, &c.), wasted itself in heat; by Joule and Jacobi, that the counter-electromotive force of the motor was the measure of degree to which it utilised the energy of the current.

I am not responsible for the fact that forty years have elapsed since these things were proved, and I do not see why Mr. Immisch should think it needful to have them proved over again. If he will produce a single fact that cannot be reconciled with them, then it may be time to verify their accuracy.

Not one single fact, however, has Mr. Immisch yet adduced that does not agree with these well-known and accepted points. He still does not see that, *cæteris paribus*, of two motors of equal power that one is the more strictly "efficient," which, when supplied from a given battery, does its work the slower by drawing a less current. For the one that does its work quicker does so by drawing more current from the battery, not only using up the zinc at a greater rate, but using up more zinc in total and wasting more of it in heating the circuit. His motor No. 2, which does its work quicker, must necessarily have a lower efficiency than his motor No. 1, since with the former there is more current frittering itself down into heat. I observe that in spite of all my pains Mr. Immisch still makes the very mistake—which he in the same letter repudiates—of confounding together the efficiency of a motor and its rate of doing work. Speaking of his motor No. 2, he suggests that its "lifting power" might be still further increased by a different winding; and then he proceeds to talk of its "effectiveness"—*i.e.*, that which he has just called its "lifting power"—as "effectiveness or efficiency *per se, as Prof. Thompson chooses to call it.*"

I beg Mr. Immisch's pardon, it is not I who have given the name of "efficiency *per se*" to the "effectiveness" or "lifting power" of a machine. Indeed, I have been most careful to explain that "efficiency *per se*" is always a *ratio*—a certain percentage—whilst effectiveness or lifting-power can only be expressed as so many foot-pounds per minute, that is to say, as a rate-of-doing-work. It is too bad of Mr. Immisch not only to keep up the confusion, but to father the confusion upon the very person who is trying to deliver him from it.

As to the motors being wound to a "resistance suitable (!) to the battery," that expression has no meaning unless one knows how the resistance is obtained. One inch of thin platinum wire may offer as much resistance as a mile of thick copper wire. Which of these "resistances" would be "suitable" to a battery of—but stay, Mr. Immisch has not favoured us with any data as to the number of cells in his battery or as to its electromotive force or its internal resistance.

The lamp experiment of Mr. Immisch exactly supports the accepted theory of a counter-electromotive force. What he observes is exactly that which he would get if for his moving motor he were to substitute a battery of equal internal resistance, and offering an equal counter-electromotive force to the main line battery. I thank him for having given me so apt an experiment in demonstration of the point.

Silvanus P. Thompson.

Reporters Not Admitted.

In your issue of the 13th inst. you have published a report of a meeting of this company held on the 5th inst. at the Cannon Street Hotel.

I am surprised that you should have allowed your paper to be the medium of circulating an unverified report.

Enclosed is a circular addressed to the shareholders of the company, and which, in fairness to all, you will no doubt publish; it will at once remove any question in reference to the Fitzgerald incandescent lamp as remarked upon by Mr. Hough. What was stated was that an incandescent lamp was not sufficient, but that an arc lamp was required to make the system complete.

The board entertain and always have entertained a high opinion of the merits of the Fitzgerald incandescent lamp.

Walter Dunlop,
Secretary.

Phœnix Electric Light and Power Company, Limited,
4, George Street, Hanover Square, London, W.
January 17th, 1883.

[We insert Mr. Dunlop's letter for what it is worth. He might, however, have mentioned why our special reporter was refused admittance to the company's meetings. Reports may be verified by others than officials of the company, we imagine. The circular referred to appears in our other columns, and the way in which the company endeavours to enhance the value of Professor Varley's report on the Fitzgerald lamp—we italicise it—is about the most comical thing we have yet seen, even in electric lighting matters.—EDS. ELEC. REV.]

Electric Lighting.

In regard to your reference in the ELECTRICAL REVIEW of 30th ult., that the Brush Electric Light and Power Company of Scotland, Limited, installed the electric light in Edinburgh, and that it was not very successful, I beg to point out that the Brush Company of Scotland was not in existence at the time and that none of its officials who are carrying out the present installations of lighting in Scotland had anything to do with this former undertaking and its success or non-success.

E. W. Beckingsale,
General Manager and Electrician, Brush Electric Light and Power Company of Scotland.
119, St. Vincent Street, Glasgow.

Who is the True Inventor of the Bell Telephone?

Daring is he who ventures to carry on a controversial correspondence with an editor in the latter's own newspaper; but your uniform courtesy to your correspondents is a guarantee that you will not use your editorial powers unjustly, and that you will conduct the correspondence, if you think fit to continue it, precisely as though you were not possessed of editorial powers.

In the first place, I say with great deference I think you have erred in stating that the experiments by Sir William Thomson with Bell's instruments were made "in confidence"; and I cannot doubt you will admit your error when you refer to the circumstances under which Sir William made the experiments.

Were not these experiments made at the International Exhibition at Philadelphia, at which all the world was invited, and where representatives from all the world were present? And did not Sir William say on oath, "Other people tried and they could not hear," and "I do not think any one except Mr. Watson and myself heard?" And, further, did not Sir William testify that he, as one of the judges on electrical matters, wrote a report on the Bell instrument? I refer you to page 330 of your Review of May 6th last for the statements of Sir William above recited. Is it, then, true that the experiments made by Sir William at the International Exhibition before all the world were made "in confidence?" I ask was it not legitimate and perfectly honourable for Sir William Thomson, or for any other person, to make an improvement in Bell's or any other instrument publicly exhibited at the International Exhibition, and to apply for a patent for any such improvement?

You are pleased to write that I have "certainly evolved a startling theory." I am not aware that my letter of the 9th inst. evolved any *theory* of any kind; I think my letter was confined to statements sworn to by Sir William, and to a statement of a fact proven, unless the sworn statements of Sir William can be controverted. Did not Sir William testify that "Bell told him that it was an essential part of his invention that the disc was to be kept up?" Did not Sir William testify that "the instrument he received from Bell, known as the 'Glasgow instrument,' had the disc cocked up," and that "neither he nor his assistants could make anything of this instrument?" Did not Sir William testify that "he continued his experiments at Glasgow for some considerable time, but never got it to speak a word?" Here, then, we have the testimony of Sir William that the instrument which Bell told him must have the disc cocked up "could not be got to speak a word!" Did not Sir William testify that "the only way it could be heard was by the ear being pressed upon the disc?" Bell's instrument with the disc cocked up, as Bell said it must be, did not speak a word, but Sir William testified that when the disc was being pressed by the ear it did speak. I ask is the instrument with the disc cocked up the same instrument as that with the disc pressed down? If it be, then it is evident that Bell's patent of December 9th, 1876, was anticipated by the Glasgow receiver.

In the case before Mr. Justice Fry in May last the defendants attempted to prove that the Glasgow instrument was an anticipation of Bell's patent, and Mr. Justice Fry decided, upon the evidence given by Sir William Thomson, Sir Frederick Bramwell, Dr. John Hopkinson, and others, that the Glasgow instrument was not an anticipation of Bell's patent, and these eminent electricians said that the instrument with the disc held up could not reproduce speech. I must again ask what was the instrument which Sir William testified he heard speak, and did not Sir William testify that it was an instrument with the disc being pressed by the ear? Was it not Sir William who discovered that the disc should be pressed by the ear? and was not that discovery made at the Philadelphia International Exhibition several months before Bell filed his patent in England on December 9th, 1876, which is the first evidence that Bell claimed to have invented an instrument capable of reproducing articulate speech, and the essential part of this patented instrument is that the disc must not be cocked up but must be held down? Prior to that date Bell said the disc must be held up, but Sir William Thomson proved, by actual experiment made in July, 1876, that the instrument, in order to reproduce articulate speech, should have the disc held down.

Sir William testified that he wrote the report about the Bell instrument "without consulting with anybody." His report contained the following words: "A thin circular iron disc held pressed against the end of the tube by the electro-magnetic attraction and free to vibrate through a very small space without touching the central pole constitutes a sounder, by which the electrical effect must be converted into sound." Sir William testified in regard to the above description, "That was my idea of it at the time, and entirely out of my own mind, remembering what I had seen and what I believed I had perceived in trying to hear the words."

Here, then, is the statement of Sir William under oath that he heard words spoken only when the disc was pressed down, and his opinion that when held down "the electrical effect *must* be converted into sound." Will any one venture to assert that the instrument with the disc cocked up, as Bell said it must be, is the same instrument as that with the disc held down as Sir William, guided by his extensive knowledge of electrical matters, said in his report about the electrical effect of the disc held down?

The above extracts from the testimony given before Mr. Justice Fry establish the important facts:—

1. The Bell instrument with the disc cocked up did not reproduce articulate speech.
2. Bell said the essential part of his invention was that the disc should be held up.
3. Sir William Thomson, by pressing the disc with the ear, did so materially alter Bell's instrument that it did reproduce articulate speech.

I now respectfully put the question to you and to all the world, and I hope you will oblige me with a reply. Does not the testimony given before Mr. Justice Fry prove that the first time articulate speech was reproduced by any electrical device was at the International Exhibition in Philadelphia in February, 1876 (if we ignore the Reis instrument), and does not the same testimony prove that the instrument which did then reproduce articulate speech was that made by Bell (which was a decided failure) improved by Sir William Thomson?

In your remarks upon my letter you wrote: "We publish the above letter more with the view of showing the writer's (we think mistaken) ingenuity, rather than for any real value it possesses."

I am not aware that my letter exhibited any ingenuity whatever; if, however, you think I exhibited any ingenuity will you kindly point it out, and say where the ingenuity was mistaken? I think I confined my remarks to quotations from the evidence before Mr. Justice Fry and to a concise statement of the fact clearly established by the evidence—to wit, that Sir William Thomson was the first to discover that a disc held down could and did reproduce articulate speech, and I boldly challenge a denial of that fact so long as the testimony of Sir William Thomson remains uncontroverted.

Sir William Thomson may not *claim* to have been the discoverer—or, rather, the inventor—of the speaking telephone; but he certainly cannot deny the fact that Bell's instrument with the disc cocked up did not reproduce articulate speech, nor the fact that with the disc held down it did reproduce articulate speech; nor the fact that it was the first time he ever heard articulate speech reproduced by an electrical instrument; nor the important fact that he was

the discoverer of the necessity of the disc being held down in order to reproduce articulate speech.

I shall, at no distant day, send to you some remarks on the "Glasgow" instrument.

W. C. Barney.

January 15th, 1883.

[We are obliged to our correspondent for his complimentary remarks. Perhaps we somewhat misled him in our use of the expression "in confidence," and we will now explain briefly what we intended to convey by our remarks. We do not see how Sir William Thomson could have acted otherwise than he did in his capacity of a judge on electrical matters, and we cannot agree that it would have been legitimate or *honourable* (under the circumstances) to have applied for a patent for an improvement. It appears clear that Bell made this instrument speak prior to its inspection by Sir William, for the latter in his evidence in the Edinburgh trial says:—Bell then said "he could show us something which *would speak*, &c." This was after Sir William had been shown other apparatus for reproducing sounds but not articulate speech.

Therefore the accidental, but more efficient way in which Sir William applied the instrument to his ear does not appear to us to possess the value attached to it by Mr. Barney, and we still think that he is misapplying his great powers of analysis in intricate matters.—EDS. ELEC. REV.]

NOTES.

The Electric Light in a Ball-room Dress.—One of the novelties at a fancy dress ball held in Hull on Thursday week was the introduction of the electric light in the ball-room dress of a lady. Small incandescent lamps were artistically introduced into the head-dress and other portions of the costume. The apparatus for this purpose was arranged by Mr. Thomas Muse, Hull.

The directors of the Metropolitan Brush Electric Light and Power Company, Limited, have appointed Mr. Radcliffe Ward, formerly chief electrical engineer to the British Electric Light Company, Limited, to be chief electrical engineer to the company.

The Chester Town Council have authorised their Watch Committee to make a representation to the Board of Trade against the granting to the Union Electric Light and Power Company a Provisional Order authorising them to work and maintain electric lines and supply electricity within their city.

Towards the end of last week the Town Councillors of Sheffield held a long debate on the electric lighting question. By 30 votes to 20 they resolved to petition the Board of Trade for leave to withdraw their memorial for a Provisional Order to supply the electric light for domestic and street purposes. They further resolved to oppose the memorial of the Union Electric Light and Power Company (Limited) for a Provisional Order. We had thought the remarks made on this point by Mr. Chamberlain in his reply to the two deputations some weeks ago could not be misunderstood; but it appears we were mistaken. If the opposition to the application of the Union Company be persisted in, which we think hardly likely, it by no means follows that it will be successful.

The Stockport Corporation have decided to abandon their application for powers to supply the electric light.

At the last monthly meeting of the Stranraer Town Council a letter from the Brush Electric Light Company anent supplying that town with the electric light was remitted to the Gas Supply Committee.

At the last conference of the Town Councillors of Forres two letters were read on the subject of electric lighting; one from the Board of Trade notifying that owing to no papers having been submitted no Provisional Order for the year 1883 could be granted, and the other from the Brush Electric Light and Power Company offering to supply the electric light on their usual terms. After some conversation the subject was allowed to drop.

The directors of the Brush Midland Electric Light Company have agreed to ask the Court for liberty to strike out from the share register the names of those shareholders who desire the return of their capital and to refund them the amount paid on their shares.

The extensive goods yards at Nine Elms station, London, have been illuminated by means of the Edison light. It is believed that the experiment will answer admirably, inasmuch that the shunting operations, with their contingent dangers, may be so much more safely carried on. The light burns remarkably clearly and steadily, and up to the present time has given general satisfaction.

The petition of Mr. Hough and another for the compulsory liquidation of the Phœnix Electric Light and Power Company came before Mr. Justice Fry in the Chancery Division of the High Court of Justice on Saturday last. Mr. Glasse, Q.C., represented the petitioners, and Mr. Everett, Q.C., the company. It was agreed, at the request of counsel, that the petition stand over till after the 23rd inst., the day on which a meeting of the company is to be held to pass resolutions for its voluntary winding-up.

The local authorities of the parishes of Shoreditch and Bethnal Green and of the district of Hackney are about to hold a conference, to endeavour to secure concerted action with respect to the Provisional Orders of the electric lighting companies. The Hackney District Board has declined to take the responsibility of a Provisional Order, but has determined to secure, if possible, the insertion of certain conditions, in the interests of the ratepayers, in the applications of the companies. It is to be suggested to the conference of parochial authorities to consider whether some arrangement might be made whereby a small central area in the borough of Hackney (Shoreditch being named as the most suitable) could be taken as a compulsory district, with, however, permissive powers to resist the advance of other electric lighting companies.

The General Purposes Committee of the Wandsworth Board of Works reported last week that they had considered the application by the Metropolitan (Brush) Electric Light and Power Company for a provisional order for the supply of electricity in the district, and had adjourned the consideration of the subject.

At a special meeting of the St. Olave's Board of Works last week it was resolved, on the recommendation of the Electric Lighting Committee, that no application be made by the board for a licence. The offer of Mr. Lane-Fox to light the district with incandescent electric lamps, "at a saving of £400 per year on the present charge for gas," was referred to the Electric Lighting Committee. The Bermondsey Vestry also last week resolved not to apply for a licence, and to oppose the proposed Provisional Order of the Brush Company, in order to have inserted such clauses as may be deemed desirable for the interest of the parish.

Some of the leading lacemakers in the district of Long Eaton have determined to adopt the electric light, and have placed the execution of their orders with the Hammond Electric Light and Power Supply Company, Limited.

We understand that at Messrs. Copestakes, Hughes and Crampton's works, where the first "Ferranti" installation has been made, it is found possible to turn out any number of lights without altering the speed of the dynamo machine. At the present time there are 100 "C" Swan lamps in use there, and on Friday night last the lights one after the other were turned out until only one was left burning. This installation has given so much satisfaction that it is, we understand, about to be increased to 500 lights. The work has been executed by the Hammond Electric Light and Power Supply Company (Limited).

The electric light has now been adopted by the Hungarian Court, and has proved highly successful. At the great court ball at Budapest on the 8th inst., the large court of the palace and the entrances thereto were brilliantly illuminated with 9 Zipernowsky arc lamps, and the halls with 80 ground incandescent lamps, the effect being very fine. Messrs. Ganz & Co., of Budapest, carried out this installation, and on several occasions previous to this ball the electric light of the same firm was used at court dinners. On the 4th inst. the Crown Prince with the Crown Princess

visited the factory of this company, where they inspected with much interest the various workrooms for the construction of electrical machines and lamps. After an hour's stay his Royal Highness expressed great satisfaction with the progress of the electrical industry in Austria-Hungary. Messrs. Ganz & Co. have furnished us with the following list of places at which they have furnished installations of their electric light :—

I. THE ARC LAMPS (of 600 candle-power each).

	Lamps.
Iron Foundry of Messrs. Ganz & Co. at Budapest	14
Electro Technical Factory ,, ,, ...	8
Waggon Factory ,, ,, ...	14
The Harbour of Fiume	8
The National Theatre at Budapest (for stage effects) ...	3
The Skating Place ,, ...	10
Factory of the Hungarian Railway Co.	14
The Café Brenner at Budapest	11
The Café Zifferer at Vienna	6
Offices of Messrs. Braun & Heider, Vienna	10
The Salt Mines at Slatina (Hungary)	20
Premises of Messrs. Neuschloss Brothers at Budapest ...	5
The Perron of the Austrian Railway Station at Vienna ...	10
Machine Factory of Mr. Liang at Budapest	5
The Great Hall of the Shooters' Company at Agram ...	4
The Wharf at Neupest (near Budapest)	6
Ironworks of the Austrian Railway Co. at Reschitrad ...	28
The Lloyd Arsenal at Trieste	20
Offices of the Austro-Hungarian Lloyd at Trieste	9
Flour Mill of Mr. St. Schwarz at Erlau	2
The Hungarian Railway Station at Budapest	14

TEMPORARY INSTALLATIONS.

The Great Redante Halls at Budapest	24
Palace of the Society of Artists at Budapest (Munkacsy Exhibition)	12
Palace of the Society of Artists at Budapest (Vereschagin Exhibition	26
Premises of the Paper Manufacturing Co. at Pelsöcz ...	5
The Industrial Exhibition at Trieste	32
The Csárda at the Industrial Exhibition at Trieste	10
The Lloyd Steamer *Berenice* (Court Ball)	2
The Great Hall of the Shooters' Company at Klausenburg ...	6
The Dining-rooms of Mr. Zeleskovics at Belgrad	8
Illumination of the Prince's Palace at Budapest	7
Illumination of the Theatre at Belgrad	3

II. THE SWAN INCANDESCENT LAMPS.

The National Theatre at Budapest	1,000
The Elevator (Great Public Grain Widgasin) at Budapest ...	195
The Gisella Steam Mill at Budapest	200
Steam Mill of Messrs. Rosenthal Brothers at Gross-Wardein	52
Steam Mill of Mr. St. Schwarz at Erlau	47
Iron Foundry of Messrs. Ganz & Co. at Budapest	100
Electro Technical Factory ,, ,, ...	60
Waggon Factory ,, ,, ...	40
Wedwing Factory at Neupest (near Budapest)	35
The Komak of the King of Servia at Belgrad	200
Brew-house at Wienner-Vleustadt	120
The Hall of the Shooters' Company at Agram	20
Offices of Messrs. Braun & Heider at Vienna	50
Spirit Brewery of Messrs. Sigmond Brothers at Klausenburg	30
Spirit Brewery of Mr. H. Mikolaseh at Lemberg	30
Private Building of Mr. Protopopescu at Bucharest	35

TEMPORARY INSTALLATIONS.

Dining-hall of the Margaretheninsel at Budapest	60
The Lloyd Steamer *Berenice* at Trieste	76
The Railway Station at Budapest	40
Steam Mill of Messrs. Vogel & Son at Simmering	40
Illumination of Two Halls of the Prince's Palace at Budapest	80

The Commissioners of Sewers, at their meeting on Tuesday week, after a comparatively short discussion, arrived unanimously at a resolution which, while boldly pledging themselves to give the citizens of London, if practicable at a reasonable price, the advantages of this beautiful light, is still sufficiently guarded to prevent any considerable loss, supposing that unforeseen difficulties should arise. The committee to whom the matter is referred are to apply to the Board of Trade for a licence which, while compulsory as to its application to a limited area of the City, will be only permissive as to the remainder. By this means the Commissioners will be enabled to try the experiment in the fullest possible manner over an area sufficiently extensive to give it a fair trial, before entering upon the grand work of supplying electricity to the whole of the City, not only for public purposes, but for all purposes to which electricity may hereafter be applied. "We have heard and read much lately (says the *City Press*) as to the inefficient way in which some of the local authorities of the metropolis carry out their various important duties. Without pausing at the present time to inquire as to the justice or otherwise of these charges, we may remark that every writer or speaker on the subject—with one notorious exception, whose audacious statement met with its due chastisement—has borne willing testimony to the admirable manner in which the Commissioners of Sewers for the City, assisted by their able officers, exercise the large powers entrusted to them by Parliament, as illustrated by the condition of the streets and the perfection of their sanitary arrangements. We are pleased to see that in this novel and important duty of so dealing with this beautiful discovery as to save the citizens of London from another burdensome monopoly, they still preserve their proud position of taking the lead among the local authorities of the metropolis."

At a meeting of the Commissioners of Sewers on Tuesday last, Mr. Innes obtained permission to adjourn the consideration of his motion, "That, in deciding on the area for compulsory lighting, the members propose as suitable areas the great centres of commerce—*exempli gratia*, banking, shipping, and dry goods—and the area be settled by show of hands without debate, and it be referred to the Streets Committee to map out the area selected."

In speaking of Mr. Conrad Cooke's report to the Sheffield Corporation last week an error was committed. Mr. Cooke was only asked to deal with *private* electric lighting, and his bare mention of street lighting was to the effect that *for the present* it might be advisable to continue the use of gas; but Mr. Cooke is by no means opposed to the use of the electric light in the streets.

We are informed that, among other large contracts for electric lighting which the Electric Carbon Storage and Apparatus Manufacturing Company of Scotland (Limited) have at present in hand, are the following :—J. Fowler and Co., Leeds, works, offices, &c., with 90 arc and 800 incandescent lamps; J. Keys and Son, Kirkcaldy, three steamers throughout; Kelly and Sons, publishers, works at Kingston; B. Hyam, establishments in Edinburgh and Glasgow; and an Edinburgh theatre.

On Tuesday evening of last week Prof. S. P. Thompson delivered a lecture at Altrincham, in connection with the Bowdon Literary and Scientific Club, on "Domestic Electric Lighting," and performed several interesting experiments with the electric lamp of Mr. Chas. Lever, of Bowdon. We have already described and expressed a favourable opinion of this lamp; and Prof. Thompson, in the course of his lecture, said of it that it was impossible to imagine anything simpler. He considered the lamp to be, if not the best, certainly one of the best ever invented, and so simple and efficient that he could not but think that it had a great future before it. Mr. Lever, who himself exhibited his lamps at the lecture, received the permission of the directors of the Literary Institute to work the lamps on the following evening in the large room, so that the public might be afforded another opportunity of witnessing what in Altrincham is an entire novelty. This room, it appeared, the Altrincham and Bowdon Philharmonic Society enjoys the privilege of using for practising on Wednesday evenings, on condition that it is not required for any other purpose. The lights were started at half-past six, but about eight o'clock Mr. Lever was requested to put them out, the excuse being that they interfered with the singing. Mr. Lever courteously replied that if such were the case he would extinguished them, although he had been allowed the use of the room that night. It was, however, impossible to do so at once, as the engine was then working under a very heavy pressure, which would first have to be lowered. Notwithstanding this, one of the members took upon himself the liberty of breaking the whole circuit, apparently quite reckless of what the consequences of such an act might be to the machines or the attendants. Fortunately, all danger was avoided through the prompt measures taken by Mr. Richardson, the maker of the lamps, who was then in charge of the machinery.

A number of additional lamps have been added to those hitherto in use at Aberdeen, for the purpose of fairly testing the electric light. The improvement is marked and a satisfactory result is anticipated.

The eminent engineers, Messrs. Siemens and Halske, of Berlin, employ the electric light for producing such photographic prints as the firm stands in need of. Messrs.

Siemens and Halske employ the platinotype process at present, and, as the printing by this method proceeds rapidly, electricity can be employed without difficulty. While of late the number of electric portrait studios in London has increased by three or four, it is said that there is but a single one in Germany and Austria at this moment, viz., that of Herr Van Rouzelen. Several establishments in Berlin and Vienna use electricity in enlarging and *lichtdruck* work; while one firm, Messrs. Winter Brothers, of Vienna, employ the electric light daily in the production of their canvas portraits. Kurtz, of New York, has started an electric light studio in the Broadway, with seven Brush lamps.

The Electrical Railway in Ireland.—The making of the electrical railway between Portrush and the Giant's Causeway (says the *Pall Mall Gazette*) marks an era in the history of locomotion. If the sanguine hopes of its projectors are realised, it will be not less remarkable in the history of Ireland. That the first electrical tramway outside Berlin should have been started in a remote corner of Ireland is due to the enterprise of the high sheriff of Antrim, Dr. Traill, whose namesake, Mr. W. A. Traill, has acted as engineer of the line. It has been built in the old-fashioned way by a company of shareholders, who raised £45,000 in £10 shares to construct six miles of rail. The line will be used not merely as a tramway, but as a railway for the conveyance of goods and minerals, electricity being in all cases the only motive-power employed. According to the sanguine estimate of the promoters, whereas the cost of working the line by horses would be elevenpence a mile, and by steam sevenpence, they expect to effect it at a cost of a penny. If they do this their success is assured. But the chances are against them. No electric motor has as yet been able to earn a dividend, and it will be an agreeable surprise if the new railway to the Giant's Causeway should prove an exception to the rule.

Re-Arrangement of Cable Offices.—Arrangements have just been completed for the establishing of independent submarine telegraph offices in New York. The cables of the Direct and the French Cable Companies will be worked from the new office and will be entirely independent of the existing land lines in America, while at the same time they will be open to receive messages from any of the land line systems of the United States.

New Submarine Cable Project.—An Australian projector, Captain Audely Cook (says the *New York World* of January 2nd), projects a cable line from the British Colonies, *viâ* the Sandwich Islands, to San Francisco.

Interesting to Cable Manufacturers.—We again hear from New York that the india-rubber manufacturers are negotiating for a consolidation of all the rubber interests in the United States. It is said that the principal object of this consolidation is to enable them to secure cheaper raw material.

Electro-Motors.—The house of Colonel Gourand, at Upper Norwood, is being fitted up with the Griscom motors.

Improvements in Telegraphic Communications with Lisbon.—We read the following in *La Lumière Electrique*:—Negotiations are at present going on between the French and Portuguese Governments for the erection of an overhead telegraph wire direct between Paris, Bordeaux, and Lisbon. This new line, when opened for traffic, will be of the greatest advantage to the telegraphic communications between France, as well as North and Central Europe, South America, and the West Coast of Africa. The establishment of this direct wire between Paris and Lisbon will do away with the mutilations and mistakes which sometimes occur in messages forwarded from Lisbon over the Spanish land lines to the different countries of the European continent.

New Cable Repairing Ships.—We notice the following in last week's *Engineering* as regards the new repairing ship which is being built for the Post-office:—The Lords of the Treasury have at last realised the necessities of the Submarine Cable Department, and have sanctioned the building of a special cable-repairing steamer, and also of proper tanks and store rooms, &c., in a portion of Woolwich Dockyard. This is a step in the right direction, the necessity of which we have frequently advocated in these columns. The ship, designed by Mr. J. H. Ritchie, in accordance with the general instructions of Mr. Graves, assisted by Messrs. Lumsden and Culley of the Marine Department of the Post-office, is being built by Messrs. D. S. Dunlop & Co., of Port Glasgow. She will be 240 ft. by 33 ft. by 20 ft., with engines working up to 960 horse-power. She was originally designed with paddles, which could be disconnected, having two engines to each paddle, but to save money the designs have been altered, and a single screw substituted. This is another example of false economy; the disconnecting paddle-wheel steamer would have been the best adapted for the work of repairing the heavy cables of the postal system, which vary from 7 to 27 tons per nautical mile. The cable machinery and fittings are being constructed by Messrs. Johnson and Phillips, of Charlton, from the designs of the Post-office engineers. The cable depôt in the portion of Woolwich dockyard granted for the purpose, is provided with tanks and storehouses, &c., and is nearly ready for occupation, and when the ship is completed, she will be moored when not at work off the depôt.

The *Dundee Advertiser* of the 10th inst. contains the following:—Yesterday a steamer, named the *Viking*, built to the order of the Western and Brazilian Telegraph Company, was launched from Craigie Shipyard (Messrs. Pearce Brothers). The vessel is 145 ft. long, 23 ft. in breadth, with depth of hold of 12 ft. to the main deck and of 19½ ft. to the spar deck; she is 460 tons gross, and has been built above the requirements of the highest class at Lloyd's. Having been specially built as a telegraph steamer, to be employed on the Coast of South America, the *Viking* has been fitted with the necessary machinery for picking up, repairing, and laying telegraph cables, and has accommodation for a large staff of telegraph engineers, besides the officers and crew of the vessel. Engines of 65 horse-power are to be fitted on board the steamer. Captain Wardroper, whose name is well known to our readers, has been appointed to the command of the *Viking*.

Telegraphic Messages.—The *Operator*, dated New York, the 30th December, contains the following news:—England has a little telegraph and news association scandal that recalls some of those we have occasionally had on this side. A writ has been issued by the Central News Agency against the Eastern Telegraph Company, of which Mr. John Pender is chairman and Sir James Anderson managing director, claiming heavy damages for appropriating and using telegrams from Egypt sent by the correspondent of the Central News. Sir James is also chairman of the Exchange Telegraph Company, a news agency which distributes news on recording instruments to business-men, clubs, and newspapers. A circular just issued by this company says, "Its reports of the principal incidents of the campaign were with hardly an exception, the first received in London." The Exchange Company had the news of the battle of Tel-el-Kebir before the Central News, although the Central News correspondent claims that he handed in his messages at the telegraph-office before any other correspondent. Sir James Anderson being managing director of the Eastern Telegraph Company and being also chairman of the Exchange Telegraph Company, which did so well during the war, his duality of position gives rise to unpleasant inferences, and the Central News Company is so much aggrieved at what it regards as bad faith on the part of the Eastern Telegraph Company that it proposes to test the matter in a court of law. If the case comes off, it is thought some queer things may come to light.

The Telephone in India.—The *Homeward Mail* says:—The Government of India have given directions for the construction of telephone lines in the city of Dewas, in accordance with the request preferred by the Maharajah of the State of that name.

Telegraphic Appointment.—Mr. William Leonard, for many years chief assistant to the late Mr. C. V. Walker,

has been appointed by the directors of the South-Eastern Railway Company telegraph superintendent to the company.

The Latest Electrical Discovery.—The Rev. Mr. Gilbert, during an address at Christ Church the other night, remarks the *Otago Times*, while speaking of the telephone, asked his audience if they would be astonished if he were to tell them that it was now proved to be possible to convey by means of electricity vibrations of light—to not only speak with your distant friend, but actually to see him. The electroscope—the name of the instrument which enabled us to do this—was the very latest scientific discovery, and to Dr. Gnidrah, of Victoria, belonged the proud distinction. The trial of this wonderful instrument took place at Melbourne on the 31st October last in the presence of some forty scientific and public men, and was a great success. Sitting in a dark room they saw projected on a large disc of white burnished metal the race-course at Flemington with its myriad hosts of active beings. Each minute detail stood out with perfect fidelity to the original, and as they looked at the wonderful picture through binocular glasses, it was difficult to imagine that they were not actually on the course itself and moving amongst those whose actions they could so completely scan.

Telegraph Inspector Killed.—On Thursday week Mr. Peter Sinclair, an inspector, who has been long in the employment of the Telegraph Department of the North British Railway Company, was knocked down and killed at Ratho Station by the 4.5 p.m. express train from Edinburgh to Glasgow. Mr. Sinclair, who resided in Edinburgh, was about forty years of age, and held in much esteem. He leaves a widow and five young children, with whom much sympathy is expressed.

The National Telegraph Clerks' Association.—The first annual dinner of the Birmingham branch of this Association was held in Birmingham on Saturday last, when upwards of fifty of the members were present.

The Royal Society of Edinburgh.—At the meeting of this society on Monday evening Prof. Crum Brown submitted the results of a large number of experiments made by Mr. Thomas Andrews, M.I.C.E., &c., "On the Electro-Chemical Position of Wrought Iron, Steel, Cast Metal, &c., in Sea-water and other Solutions." Mr. Andrews found that the relative electro-chemical positions of these metals were not static, and a marked result of the observations was the steadily changing deflections introduced from the beginning, frequently resulting in a complete exchange of the electro-chemical position of the metals. The practical deduction was that the danger from increased corrosion in sea-water, which the experiments displayed, was not to be disregarded by the engineer in dealing with metals.

On the Electric Resistance of Glass at Low Temperatures.—By M. G. Foussereau.—The method employed consists in passing through a test-tube, closed at one end, 0·01 to 0·02 metre in diameter and very regular in thickness, the electricity furnished by a battery of from one to 100 elements. This electricity is collected in a condenser of known capacity, the two coatings of which are connected to the two mercuries of a Lippmann electrometer, the capacity of which had likewise been measured. The time necessary for communicating to the mercurial column of the electrometer a displacement corresponding to a given difference of potential was observed.

The test-tube is placed on a larger glass; the two surfaces of this tube are in contact up to a certain height with two conductive masses of concentrated sulphuric acid, into which penetrate platinum wires carefully insulated from the sides of the tube above the liquid level. The apparatus is surrounded with a glass case, the air of which is dried by means of sulphuric acid before beginning the experiments.

In order to obtain a uniform and slowly variable temperature, the base of the apparatus is placed up to a level considerably above that of the acid in an oil-bath, which again is substituted for a sand-bath capable of being progressively heated. A freezing mixture may be substituted for the sand-bath, and the observations may be carried as far as — 17° C.

If we call—

E the electromotive force of the battery;

ρ_1 and ρ_2 the internal and external radii of the tube;

h the height of the liquid;

r the specific resistance of the glass per cubic centimetre;

C the sum of the capacities of the condenser and the electrometer;

e the difference of potential communicated to the electrometer, which is always very small with reference to E, we have then, expressing the quantity of electricity transmitted by the glass which, in the time θ, has served to charge the condenser—

$$r = \frac{2\pi h \mathrm{E}}{Ce \log_e \frac{\rho_2}{\rho_1}} \times \theta.$$

Several experiments, made with different heights of sulphuric acid, served to eliminate the influence of the bottom of the tube, which has not the same thickness as the sides.

At the moment when the circuit is established, the glass tube becomes charged at first like a condenser.

Its internal layers absorb then by degrees a certain electric charge necessary to bring them to the final state which corresponds to the fall of potential established between the surfaces. During this variable state, which is more or less prolonged according to the nature of the glass, the effects of the charge of the glass are superimposed upon those of conductivity. Observations are taken when the time of charging the electrometer has assumed a constant value.

I have observed also that a rapid increase determines an apparent increase of conductivity greater than the normal increase; in like manner, a rapid lowering of temperature gives rise to an exaggerated resistance. But these phenomena disappear rapidly, giving place to the normal resistance, and they are no longer produced when the variations of temperature are slow.

My observations extend to three kinds of glass: common glass with a base of soda and lime, Bohemian glass, and "crystal."

In all three cases a rise of temperature produces a rapid increase of conductivity. The resistance may be expressed by exponential functions of the form

$$\log x = a - bt + ct^2.$$

1. For common glass, of specific gravity 2·539, expressing the resistances per cubic centimetre in millions of megohms, we obtain the following results:—

Temperatures.	Resistances.
+ 61·2° C.	0·705
+ 20	91·0
— 17	7970·0

To form an idea of the magnitude of this latter resistance we may remark that it represents about twice the resistance of a copper wire of one square millimetre in section, extending from the earth to Sirius. The total results obtained upon common glass is expressed by the formula:—

$$\log x = 3{\cdot}00507 - 0{\cdot}052664 \times t + 0{\cdot}00000373 \times t^2.$$

The term of the second degree being very small, the values of $\log x$ are expressed by a line differing little from a straight line. The resistance varies about by one-ninth of its value per degree of temperature.

2. The hard glass of Bohemia, of specific gravity 2·431, upon which I have operated, is from ten to fifteen times more conductive than ordinary glass at the same temperatures. Its resistance is given by the formula:—

$$\log x = 1{\cdot}78300 - 0{\cdot}049530 \times t + 0{\cdot}0000711 \times t^2.$$

3. The crystal used has the specific gravity 2·933. It is, on the contrary, from 1,000 to 1,500 times less conductive than ordinary glass at the same temperatures. Its conductivity is only manifested above 40° C. At 46·2° C. its resistance = 6182; at 105° = 11·6.

The results are expressed by

$$\log x = 7{\cdot}22370 - 0{\cdot}088014 \times t + 0{\cdot}00028072 \times t^2.$$

Comptes Rendus.

On the Thermic Phenomena of the Induction Spark.—By A. Naccari.—A brass tube of 12 centimetres in diameter, introduced into the middle aperture of a Woolf's bottle, was closed below hemispherically; it contained 8 grms. of water and a thermometer. In a lateral aperture of the Woolf's bottle a wire was fitted by means of a cork, and terminated in a brass ball, 10·1 millimetres in diameter below the tube, and at a distance of 3·5 millimetres from its lowest part.

The Woolf's bottle was exhausted and the heating of the water in the tube on passing the currents of an inductorium in one or the other direction, was observed by means of the intercalation of a thermometer.

The circuit had to be interrupted by an extent of air 2 mm. in length, in order that the discharges might be entirely directed in one way; otherwise the results would have been irregular.

With the decrease of pressure the heating of both electrodes diminished.

The proportion of the heating of the negative and the positive electrode increases thereby, from 3 at the pressure of the atmosphere, to 4 at a pressure of 11 millimetres of mercury. If an interruption is present in air sufficiently rarefied, the indirect induction current antagonistic to the inducing current preponderates, if the electromotive force is sufficiently great.

In further experiments at the pressure of the atmosphere a condenser was introduced into the circuit. For this purpose the positive pole of the inductorium was connected with a ball, opposite which was placed another ball, connected with the coating of a condenser (a Leyden battery). The same coating was connected with one electrode, a hollow brass ball, 5 centimetres in diameter, filled with petroleum; whilst the other coating was in communication by means of the galvanometer, with the other similar electrode, and the other pole of the inductorium.

In these experiments the proportion of the heating of the negative and positive electrode diminished with the increasing capacity of the condenser down to 1, after which changes had no effect. Up to a certain capacity the heat produced in both electrodes is differently distributed. If the capacity is greater the heat increases to a maximum and then declines again.

Finally, into a thin glass globe, with two small tubulures, there were introduced two copper wires 3 millimetres in thickness, the very even end surfaces of which were at the distance of 7·8 millimetres from each other. The ball was placed in a calorimeter full of water (75 cubic centimetres), through which the copper wires are led, insulated. As the intensity of the current increased the potential difference between the electrodes, derived from the heating, decreased. A condenser introduced into the circuit reduces the mean potential difference of the electrodes the less as the capacity is greater. This potential difference derived from the heating is very much smaller than that recognised by Thomson and others at the commencement of the discharge. —*Wiedemann's Beiblätter.*

Heating of Non-Conductive Insulating Solids and Liquids by Alternating Electrostatic Polarisation. By Maccari and Bellati.—Siemens and Righi have previously recognised such cases of heating in solid bodies. The authors fixed in a test-tube a smaller one, by means of a cork, and filled the interstice between the two with petroleum, into which was introduced a capillary tube. The test-tubes were coated and lined with tin-foil, and the inner one was filled with mercury. The coatings were connected with the poles of an inductorium. The petroleum was found to expand, as also benzol. If a Leyden jar was introduced into the induction circuit more important effects were produced.

The charge cannot be derived from an alteration in the volume of the vessel, due to the electric pressure, as it continues for some time after the discharge. A much slighter expansion is observed if the apparatus is filled with water (the rise being 0·35—0·20 with water, as against 10·8—9·3 with petroleum), so that it cannot be due to the decomposition of the fluid.

If the inner test-tube was coated with tin-foil on both sides, and if the inner as well as the outer coating was connected with the poles of the inductorium by means of an insulated wire passing through a cork, the petroleum rose in the same manner between the glasses.

A copper cylinder, 4 centimetres high, 3·3 thick, and open at both ends, was set in a glass, and there was placed within a second copper cylinder 4 centimetres in height, 1·6 centimetres wide, closed below and tapering upwards to a neck like that of a bottle. In the latter there was placed a capillary tube, running horizontally, and dipping with its end into a glass of benzol. This glass was filled with pure benzol and plunged into a vessel set in saw-dust. On connecting both metal cylinders with the induction apparatus the air in the inner cylinder was always expanded. On filling the glass with water or air nothing occurred. Similar results were obtained with a Bunsen voltameter made out of a test-tube (and having platinum electrodes of 40 square centimetres in size, and placed at a distance of 5·5 millimetres from each other) on alternately electrifying the electrodes and placing a capillary tube upon the orifice.

A current passing through the liquid between the cylinders of the apparatus described above could not be demonstrated by means of a sensitive galvanometer.

In two apparatus like that first described, but with white-metal plates of different size (in the proportion of 1·2) the expansion was larger in the larger apparatus, whilst when it depended on a conduction of the current it would be smaller according to Joule's law. The heating of dielectric bodies of alternating dielectric polarisation is thus beyond doubt.—*Atti di Torino* and *Wiedemann's Beiblätter.*

On the Use of the Electrometer in Measuring the Resistance of Liquids According to Mance's and Wheatstone's Methods, and on the Resistance of certain Alcoholic Solutions of Potassa.—By G. Guglielmo.—The author finds that in the determination of resistances Wheatstone's method has a great advantage over that of Mance, and he uses an electrometer in the bridge. The current of the circuit is only closed momentarily, and at the same time the electrometer is separated from the bridge by means of a suitable key. Thus the interval of time between the close of the circuit and the separation of the electrometer is vanishingly small, and the polarisation is without essential influence upon the electrometer, as was proved by experiments with a decomposition apparatus consisting of platinised platinum plates, 15 centimetres square.

The conductive force, K_t, of solutions of potassa in alcohol at the temperature, t, is thus found for different numbers, N_{12}, of molecules. The author gives his results in a table.

For determining the electromotive force of the polarisation Guglielmo introduces into one branch, C D, of the Wheatstone combination, A B C D A, the battery and the polarising apparatus, makes the branches, A B = B C = r, connects D with the earth, B with the electrometer, and makes the resistance of the branches A D = C D. Then the potential difference read off on the electrometer is $\Delta = \frac{1}{2}(E - e)$, where E represents the electromotive force of the circuit and e that of the polarisation. If E is known e may be calculated. If the conduction to the earth is introduced not at D, but at a point, D_1, between the circuit and the polarising apparatus, and if the resistances are again made A B = B C and A D_1 = D_1 C, the potential difference in the electrometer is $\Delta_1 = \frac{1}{2}(E + e)$, so that both E and e may be deduced from Δ and Δ_1.

If, *e.g.*, a large positive electrode of zinc and a zinc-wire enclosed in a glass tube up to its end (which is 4·5 millimetres long and 3·3 in thickness) the electromotive power of the polarisation of the zinc wire by hydrogen = 0·45 D. —*Wiedemann's Beiblätter.*

Influence of Pressure upon the Conductive Resistance of Mercury—By R. Lenz.—A thermometer tube, 1·2 metre in length, was expanded at its ends in the shape of two cups, 1 c.m. in width, and filled with pure dry mercury free from air. The current was led to the cups by means of platinum hooks. The tube was placed in a piegometer in which the pressure could be raised to 60 atmospheres, and which was surrounded with ice. Two platinum wires connected the platinum hooks with the clamps of the

piegometer. The resistances were measured according to Wheatstone's bridge method.

The resistance of the copper wires admitted of being neglected; that of the platinum wires, according to thickness, varied from 0·51 to 0·27. The resistance of the mercury was about 7·5. On increasing the pressure from 0 to 60 atmospheres, the resistance decreased 0·02 per cent. for each atmosphere. The decrease is approximately proportional to the pressure.

If the tube is filled in a vacuum by means of Weinhold's distillation apparatus, or by sucking in the mercury the resistance is in the first case 0·12 per cent. smaller than the latter.—*Wiedemann's Beiblätter.*

Method of Measuring Reactive Forces by the Radiation of Electricity.—By F. Melde.—The author has published in the *Zeitschrift für Instrumenten Kunde* a method of which the reactive power of escaping liquids can be measured by the torsion-force of a wire, according to the well-known arrangement of Segner's water-wheel. The instrument which he has constructed admits of the performance of approximately accurate experiments.

This method of opposing the torsion of a wire to reacting forces, and thus comparing the latter with each other, or measuring them absolutely can, he finds, be very well applied to the radiation of electricity from points, as in the so-called electric fly-wheel. As it has not been attempted, to his knowledge, to measure these forces, strictly speaking he believes that various useful results may be drawn from the method indicated.

It will scarcely be needed to refer to the various questions which may here find a solution. We may remember the influence of the nature of the points as to shape and material; the influence of the source of electricity, the means of conduction, the surrounding medium, the difference between positive and negative electricity, and we must, therefore, admit that there is here much to be determined. The author is at present engaged with the further investigation of this subject.—*Wiedemann's Beiblätter.*

NEW COMPANIES REGISTERED.

Liverpool Electric Supply Company (Limited).—Capital £10,000, in £5 shares. Objects: To produce and supply electricity or other similar agency for lighting and other purposes. The signatories (who subscribe for one share each) are as follows:—*A. B. Holmes, *J. C. Vaudrey, W. L. Jackson, *C. F. Smith, *A. H. Holmes, E. L. Lewes, and Philip Eberle, all of Liverpool and neighbourhood. Directing qualification: Shares to the nominal value of £200. Solicitors: Snowball, Smith and Lewes, 5, Crosshall Street, Liverpool. Registered 10th inst. by G. Maclaren, 22, Chancery Lane.

Domestic Telephone Company (Limited).—Capital, £2,000, in £1 shares. Objects: To carry on the business of telephone and telegraph company, and of an electric light, heat, and power supply company, in all branches. Signatories (with one share each):—R. H. Krause, 34, Walbrook; J. E. Kingsbury, 67, Brailsford Road, Brixton; C. Cooper, 24, Ernest Road, Forest Gate; W. G. Card, Mallinson Road, Wandsworth Common; T. R. Grigg, 28a, High Street, Hampstead; B. H. Antill, 8, Osborne Terrace, Clapham Road; W. H. Wood, Roseland, Surbiton. Registered, without articles of association, on the 12th inst., by Frederic Clift, 111, Cheapside.

*Signatories to whose names an asterisk is prefixed are also directors.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Electrical Insulator Manufacturing Company (Limited).—The return of this company, made up to 2nd ult., was filed on the 15th inst. The nominal capital is £100,000, in £1 shares. 19,371 shares have been taken up. Upon 5,296 shares 15s. per share has been called up and the full amount upon the remaining 14,075. The calls paid amount to £16,547, leaving £1,500 unpaid. Registered office, 31, Lombard Street.

NEW PATENTS—1883.

179. "Telephonic transmitters." H. ALABASTER and T. E. GATEHOUSE. Dated January 11.

180. "Electric lamps." T. E. GATEHOUSE and H. ALABASTER. Dated January 11.

181. "Improved arrangement of appliances for electrically controlling and regulating the speed of engines employed for driving dynamo-electric machines." J. RICHARDSON. Dated January 11.

183. "Electric arc lamps." J. G. LORRAIN. Dated January 11.

184. "Dynamo or magneto-electric machines and apparatus to be employed in connection therewith." H. H. LAKE. (Communicated by C. L. R. E. Menges.) Dated January 11.

187. "Modes of producing electric light." J. A. BRIGGS. Dated January 12.

205. "Posts for supporting wires for telegraphic and other electrical purposes and electric lamps." C. E. J. MAY. Dated January 13.

217. "Improvements in working and regulating secondary batteries, and in machinery or apparatus therefor or connected therewith." J. S. SELLON. Dated January 13.

243. "Galvanic batteries." H. H. LAKE. (Communicated by A. Skene and F. Kühmaier.) Dated January 15.

258. "A strain governor for marine and stationary engines and other motors (for electric generators)." J. MUNRO. (Communicated by G. Keith.) Dated January 16. (*Complete.*)

261. "Electro-telegraphic systems." P. M. JUSTICE. (Communicated by F. M. Foote and H. C. Goodspeed.) Dated January 16. (*Complete.*)

270. "Machinery or apparatus for stamping letters, post cards, and other articles, and for counting the same, parts of which improvements are applicable to mechanically or electrically worked counters and their accessories for other purposes." A. HOSTER. Dated January 17.

275. "Method of and apparatus for applying alternating electric currents to the production of light." A. MUIRHEAD. Dated January 17.

282. "Primary electric or voltaic batteries." M. R. WARD. Dated January 17.

285. "Electric lamps and batteries." J. UNGER. Dated January 17.

287. "Accumulators for storing electrical energy and devices for facilitating the transport thereof." H. H. LAKE. (Communicated by N. de Kabath.) Dated January 17.

288. "Regulating and controlling electric currents." H. H. LAKE. (Communicated by N. de Kabath.) Dated January 17.

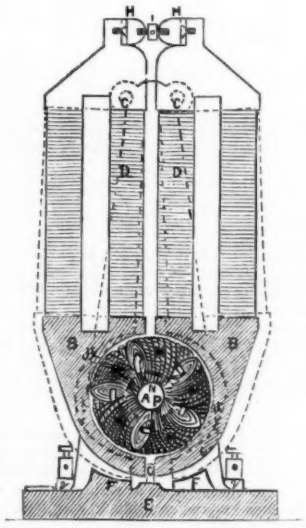
ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1882.

1642. "Incandescent electric lamps." W. H. AKESTER. Dated April 5. 6d. Has for its object, to facilitate and improve the manufacture of incandescent electric lamps, to prepare the carbon in an improved manner, and to strengthen and improve the connections of the carbon with the current wires.

2192. "Manufacture of bridges or loops for incandescent electric lamps." C. J. ALLPORT. Dated May 10. 4d. The invention has for its object to provide for incandescent electric lamps, bridges, or loops, which shall be more durable than those hitherto made. Consists generally in forming bridges or loops of asbestos filaments of fibres in combination with carbon, the said filaments or fibres being so embodied, interlaced, plaited, matted or laid lengthwise with or amongst the carbon as to render the combined bridge or loop more tenacious than if it were of carbon alone, thereby preventing breaking or cracking.

2295. "Compensating dynamo-electric machines." B. H. CHAMEROY. Dated May 16. 6d. This invention has for its chief object the construction of dynamo-electric machines in such a manner that when the resistance in the line is suddenly reduced, this reduction will not cause the accumulation of considerable electromotive force in the dynamo machine, by which accumulation not only are these machines injuriously affected, but their speed being suddenly checked, they are rendered liable to injure the motor which actuates the same. On a suitable bed plate is provided a standard or standards which afford bearings for two short axles, shafts, or pins, from each of which is pendent an electro-magnet the lower end of which is so shaped that, when the two electro-magnets are suspended opposite one another, a circular or nearly circular space will be formed between them, and this circular space is the magnetic field. Instead of using an armature revolving in the magnetic field, and constructed in the usual manner, the inventor employs an exciting coil. It consists of a shaft upon which is fastened, so as to form a helix or spiral, a wire or wires (cable) which carries a suitable number of coils (bobbins) which may or may not have solid metal pieces inserted between them. The two electro-magnets are free to approach the exciting coil (and one another) or to recede therefrom, the extent of this motion being limited by a set screw and spring or springs at their upper end and by a stop at the bottom. On the bed plate at each side are fixed blocks of metal, one block opposite each magnet. Now if the amount of current evolved is greater than that which could be taken up by the line which the machine supplies, the excess current increases the magnetism of the electro-magnets and sets up attraction between these and the above mentioned metal-blocks; thereby the magnets are caused to recede from the exciting coil and induction decreases so that the same speed of the prime-motor will produce a diminished current. In another form of dynamo-electric machine embodying the

invention the electro-magnets are arranged by the side of or around a shaft. One end of this shaft carries the exciting coil which is mounted upon a sleeve free to slide upon said shaft. At the other end of the shaft a pair of governor balls or equivalent are mounted and connected by suitable links with the shaft and also with the sleeve on which the exciting coil is fixed. On motion being imparted to the shaft centrifugal power acts upon the balls which shift the sleeve, so that the exciting coil approaches the magnet; when the current becomes excessive the attraction of the magnets increases and with it the resistance which is offered to the rotation of the exciting coil. This slackens the speed, the balls (under the action of a coiled spring surrounding the shaft and whose tension is adjustable) approach the axis of their rotation, shift the sleeve and thus move the exciting coil away from the magnets. The coils are of helicoidal form, and to collect the current the inventor joins the internal wire of one coil to the external wire of the next, and solders these two wires to another wire which is joined to the corresponding condenser. A modified form of the "exciting coil" consists of a shaft having collars between which wires or rods carrying coils of conducting wire are so placed that the two ends of each rod are diametrically opposite to one another; the ends of the conducting wires are joined up with the condensers; or the rods may carry the coils hereinabove described joined in the same manner. Fig. 1 represents the first form of the machine as



follows:—A, exciting coil, B B, electro-magnets, C C, axles or centres upon which the electro-magnets move, D D, plummer blocks or brackets, E, framing, F F^1, metallic masses, G, abutting piece, H H, springs firmly connected with the electro-magnets, I, adjusting screw, J J, brushes, K K, magnetic fields, L, iron wire conductor, M M, coils, O, orifice of hole in shaft, P, shaft, q q^1, terminals. The electro-magnets are movable and supported on the axles, C C, they are capable of moving away from the exciting coil, A. When rotary motion is imparted to the exciting coil, the current is immediately established on connection being made between the terminals, q and q^1, and the light appears at the lamp included in the circuit. If by accident contact is made between the carbons of the regulators, or several lamps are extinguished, a considerable quantity of fluid is immediately accumulated in the dynamo-electric machine and would cause a resistance which would absorb the total power of the motor furnishing the power; the above indicated arrangements prevent this disastrous effect as the lower part of the electro-magnets, K K, by reason of their magnetisation, will move towards the metallic masses, F F^1, and the separation of the magnetic surfaces, K K, from the exciting coil, A, diminishes the power of induction upon the coil, A, and it follows that the current loses its intensity and the motor which operates this dynamo-electric machine always furnishes the predetermined duty which can be regulated by the screw, I, acting upon the springs, H, so arranged as to prevent free action of the oscillatory motion of the electro-magnets towards the metallic masses, F F^1. The coil is constructed as follows: On a cable or core of iron wire, L, are wound coils, m m m, whose quantity is proportionate with the length of the cable, L; the end, N, is inserted in the opening, O, of the shaft, P, the cable thus covered is wound helically round the shaft, P, and its other end is in a similar manner inserted in an opening in the shaft. The coil is helicoidal in shape, and to collect the current the inventor joins the internal conducting wire of one coil with the conducting wire upon the outside of the next coil; these wires are soldered to another wire which is fixed to the corresponding collecting device and continues this mode of joining with the other coils.

2391. "Secondary batteries, &c." J. PITKIN. Dated May 20. 6d. Relates particularly to improvements in the construction of the secondary batteries described in a former application for letters patent dated December 13th, 1881, No. 5451, but is also applicable to other secondary and primary batteries, and it consists in an improved construction of frame to contain the lead peroxide and metallic lead without the use of felt now employed for the purpose of enclosing the same, and which augments the internal resistance of the battery and is otherwise objectionable. The improved frame is so constructed as to allow free access of the electrolytic liquid to the element, and yet prevent the lead peroxide or spongy lead falling out or to the bottom of the cell. The frame may consist of enclosing surfaces formed of louvre-like strips or laths of ebonite, wood, or other suitable material fixed across a suitable rectangular or other frame, the laths being placed obliquely and slightly overlapping one another, so as to leave interstices, through which the liquid has free access. A set of these louvre-like laths may be fixed to the opposite sides of the frame, the plates of the two sets being inclined inwardly and downwardly, and they may be fixed by having their ends inserted in inclined slits in the side bars of the frame or in any other convenient manner. Between these two oppositely inclined series of laths, the lead turnings or other thin shreds of lead of which the electrode is made, are packed. Or the enclosing surfaces of the frame may be thin plates of wood, ebonite, or other material perforated as closely as possible over their whole surface with holes or apertures of any shape, but inclined downwards and inwards, the holes being preferably of such dimensions and at such an angle, having regard to the thickness of the plate through which they are made, that the lower side of the hole on the outer surface of the plate shall overlap or shall at least be as high, or nearly so, as the upper side of the hole on the inner surface of the plate.

2397. "Application of electricity as a detecter in safely closing windows, &c." B. COYLE. Dated May 22. 6d. The object of this invention is to detect burglarious attempts on dwelling houses, banks, and so forth, by aid of electric alarms, and by this means preventing the opening of windows or forcing of doors. In applying the principle to windows, to prevent entry thereat by pushing aside the latch from the outside, the following is the *modus operandi*:—The upper portion of the window sash is recessed or hollowed out for the reception of two magnetic poles and insulated wires in connection therewith, these latter being led from one side of the centre of the sash where they are connected with two strips of copper or other conducting material which extends the whole length of the rising of the upper sash; the wires communicate also with a battery or cells in the usual manner. The knob of the latch at the lower portion in its backward and forward movements passes over a spring fixed at one end to the latch plate, this spring terminates at its free end with a projection, or what is termed a divider, as it either breaks or restores contact of the poles in its upward or downward movements, a recess being made through the latch plate to admit of its free movement up and down. The action is as follows: supposing an attempt is made to force the latch back by aid of a knife from the outside, immediately the latch is moved the spring divider alluded to rises from between the poles as the latch is removed from the spring, which latter then rises, and one of the poles being connected to a spiral spring at once advances to meet the other or fixed pole, and as soon as the two are in contact, an electrical communication is effected by aid of the wires and battery, with an ordinary electric alarm bell. Outside of the frame of the lower sash are two springs to which copper or brass points are attached, which, when the window is raised, are kept in contact with the recessed slip in the side of the rising portion of the sash, thus causing the alarm to ring as soon as there is any rising of the sash, or should there be any negligence in closing the latches.

2409. "Electric accumulators or secondary batteries." H. H. LAKE. (Communicated from abroad by H. Lory, of Paris.) Dated May 22. 2d. Relates to accumulators or secondary batteries, and has for its object to considerably augment the electrical capacity of the well-known accumulators invented by Gaston Planté without increasing their weight or volume, and so as to render practical their employment for lighting purposes, for motive power, and for other purposes requiring an electric current of great intensity for a considerable period of time. The said invention consists essentially in the application of small pieces of lead to the electrodes of Planté accumulators. (*Provisional only.*)

2414. "Insulating materials." J. A. FLEMING. Dated May 22. 4d. Relates to the preparation or production of insulating materials or articles; that is to say, materials or articles which when used for such purpose are capable of interrupting the communication or preventing the escape of electricity; and it has reference partly to former inventions in respect of which the inventor obtained Letters Patent dated the 23rd April, 1881, No. 1762, and the 5th December, 1881, No. 5309. According to one part of the present invention the inventor prepares the materials by taking solid wood (preferable English poplar) and thoroughly desiccating the same either in a vacuum or by superheated steam or otherwise, and then impregnating it under pressure with a mixture of melted bitumen or asphalte, and substances of the paraffine, anthracene, or resin type. Among the substances of the paraffine type which may be used in the said mixture are paraffine proper, hatchettine or mineral tallow and sheererite. Among the substances of the anthracene type which may be used are anthracene napthaline pyrene and chrysene. The resins which may be used are resins either fossil or recent. In lieu of employing solid wood the inventor takes wood in a finely divided condition, or other vegetable fibrous material, such for example as wood, flour, bran, straw, cotton, jute, hemp, papier maché in a finely divided condition, or asbestos, and having thoroughly desiccated the same in a vacuum, or by superheated steam or otherwise, he saturates or impregnates it under pressure or not with one of the mixtures before mentioned, and then moulds the mass under pressure into the required shape.

2419. "Electric arc lamps." W. H. AKESTER. Dated May 23. 6d. Has for its object, by improved automatic mechanism, to increase steadiness and uniformity of action in electric arc lamps. In a lamp made with the improvements the carbons are vertical and the holder of the upper carbon is fixed to a spindle formed with one or more screw threads of quick pitch and which works in an internally screwed block fitted so that it can turn in a short tube or guide. The internally screwed block has formed on it a ring, which is by preference of a conical form and is made with fine teeth; and on opposite sides of the toothed ring there are teeth fixed to a forked lever centred on a

fixed part of the frame. The lever is connected to the core of a solenoid through the coil of which the lamp current passes, and when the lever is held up by the solenoid its teeth engage with the ring of the internally screwed block and prevent that block from turning; but when from the consumption of the carbons or other cause the strength of the lamp current is lessened the solenoid allows the lever to fall and set free the internally screwed block. This block then rotates, which allows the screwed spindle to descend and the carbons approach each other. On the full strength of current being re-established the solenoid raises the lever, which engages with the internally screwed block, and preventing its rotation lifts it and the screwed spindle and carbon the distance desired for the luminous arc. The solenoid may be provided with a second or shunt coil of high resistance as usual to render its action certain; or an electro-magnet may be used instead of the solenoid.

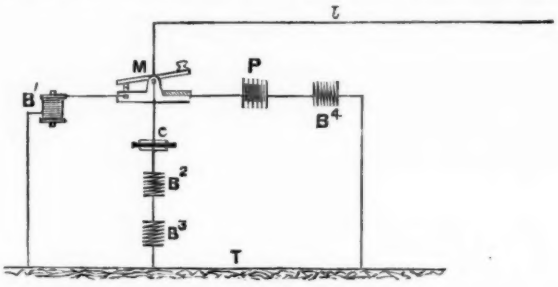
2425. "Incandescent electric lamps, &c." J. J. BARRIER and F. TOURVIEILLE DE LAVERNÈDE. Dated May 23. 6d. The general objections to the incandescent lamps as at present employed are their mode of construction; the impossibility of renewing the carbons without replacing the lamp; the short duration of the carbons employed; the impossibility of obtaining with carbonised fibres carbons of such a homogeneity that they all have the same resistance for lamps of the same model or description; and lastly, the difficulty in producing a complete vacuum in the lamp. The essential characteristics of the invention obviate these defects, and constitute apparatus which are simple in construction and of great strength and solidity in all their parts with a certain, practical, and prolonged action.

2432. "Incandescent electric lamps." G. G. ANDRÉ. Dated May 23. 6d. In the specification of the patent No. 4654 of 1881 the inventor described a mode of preparing carbon bridges or burners for electric incandescent lamps by filling the pores of the carbon, or of the yet uncarbonised material, with linseed or other drying oil, allowing the oil to oxidise, and then carbonising or calcining the material or the carbon. He now wishes to extend this process to the production of burners mainly from this oxidised oil; he takes loose uncompacted vegetable fibre or thread such as from flax, cotton, hemp, China grass, or other similar materials, and immerses it in boiled linseed oil. Then he removes from it as much of the absorbed oil as possible by drawing it first between the fingers, and afterwards between blotting paper. The thread is then exposed to a temperature of about 140° F, till the oil is fully oxidised. The process is repeated several times till sufficient oil has been taken up. When carbonised, the burner prepared in this way is quite different in its physical qualities from one prepared from thread alone. The former is dense, hard, rigid and breaks with a short clean fracture, while the latter is soft, loose in texture, flexible, and breaks with a ragged fracture like wood. The former too is of course much more conductive than the latter.

2437. "Telephonic apparatus." W. R. LAKE. (Communicated from abroad by C. E. Chinnock, of America.) Dated May 23. 6d. Relates to telephonic apparatus and comprises the combination in a telephone system of a central office, a complete metallic circuit extending between the central office and the places of business or residence of subscribers, means in the central office whereby the subscribers may indicate to an attendant there that they desire to be put in communication with others, and means whereby portions of said metallic circuit which extend between these subscribers and the central office may be removed from the circuit aforesaid; the said circuit may be closed at the place of removal, and the subscribers thus cut out of the circuit may be put into communication. It also comprises the combination in a telephone system of a central office, a complete metallic circuit extending to the central office and to the places of business or residence of subscribers, means in the central office whereby the subscribers may indicate to an attendant there, that they desire to be put in communication with others, and means where portions of said metallic circuit which extend between these subscribers and the central office may be removed from the circuit aforesaid, the said circuit may be closed at the place of removal, and the portions thus removed from the circuit may be united to form a private complete metallic circuit affording communication between the subscribers to whom the portions of the circuit so removed and united belong. It also comprises the combination with telephone instruments in a central office and at subscribers' places of business or residence of a complete metallic circuit comprising pairs of wires extending between the central office and the several subscribers' places of business or residence, means whereby any of the said pairs of wires may be removed from the circuit, and means whereby on the removal of any of the said pairs of wires the circuit will be closed at the place of their removal. Preferably the means for closing the circuit will operate automatically on the removal of the said pairs of wires. It also comprises the combination with telephone instruments in a central office and at subscribers' places of business or residence of a complete metallic circuit comprising pairs of wires extending between the central office and subscribers' places of business or residence, means whereby any of the said pairs of wires may be removed from the circuit and connected electrically with another pair of the said wires, and means for closing the said circuit at the point whence the said pairs of wires were removed from it.

2456. "Apparatus for driving dynamo-electric machines." J. SWALWELL. Dated May 24. 2d. Relates to the construction of an improved apparatus specially applicable for driving dynamo-electric machines, from a motor or pulley, the shaft of which shall be in the same axial line as the shaft of the dynamo machine to be driven, and whereby a high speed will be given to the dynamo machine from a motor having a comparatively slow speed and space be economised. (*Provisional only*).

2466. "Telegraphic and telephonic apparatus." W. R. LAKE. (A communication from abroad by F. van Rysselberghe of Belgium, dated May 24. 6d.) Relates to apparatus whereby telephonic and telegraphic messages may be transmitted simultaneously through the same wire. The currents employed for electrical communication may be divided into three classes, viz.—Currents of a certain duration, such as those used for operating the "Morse" telegraph; instantaneous currents, such as those utilised for the "Hughes" telegraph; and undulatory or wave-like currents, such as those employed for operating harmonic telegraphs and telephones. In the figure let M be a manipulator of any kind for currents of a certain duration or by preference a device for making and breaking contact in the case of a gradual current. Also let P be a battery, C a condenser, B^1 a receiver of any kind for currents of a certain duration, B^2 and B^3 a receiver and a transmitter of undulatory or wave-like currents, B^4 a suitable resistance-coil or the like, if such be necessary, and *l* a line wire connecting one station thus fitted up with another station fitted up in a similar manner. By this



means it is possible to employ for telephonic communication or for harmonic telegraphy a wire in full use for telegraphing by means of currents of a certain duration or by means of instantaneous currents, which has not heretofore been practicable. All the devices above mentioned are not indispensable, and they may be modified if desired; thus in certain cases the resistance, B^4, will not be necessary, in other cases the condenser, C, may be dispensed with, a commutator may also be employed for putting out of circuit during transmission the receiver, B^2, and during reception the transmitter, B^3; or these two latter devices may be placed in derived circuits. The said invention allows of messages being sent by means of currents of a certain duration or by means of instantaneous currents at the same time that messages are sent by means of undulatory or wave-like currents and by the same wire. In the circuit in which the receiver, B^2, and transmitter, B^3, are placed a coil may be inserted induced by the resistance, B^4, and constructed in such a manner as to annul the instantaneous current which passes towards the said condenser, C, at each completion of the circuit by M.

2480. "Compound for electrical insulation &c." F. FIELD. Dated May 25. 2d. According to the present invention the inventor produces a compound suitable for electrical insulation and other purposes by mixing with woody fibre or cellulose in a fine state of subdivision the substance known as "black wax," being the residue of the distillation of the mineral ozokerit, or a compound of this material with india-rubber or gutta-percha, produced either as described in Matthiessen's Patent, No. 3778 of 1869, or as described in Field and Talling's Patent, No. 1938 of 1875.

2491. "Secondary batteries." C. W. VINCENT. (The result partly of a communication to him by William Buller Fullerton Elphinstone.) Dated May 25. 2d. The object of these improvements is to construct secondary batteries in a more economical manner than heretofore as regards their durability, bulk, and weight. In constructing a battery according to this invention, metallic plates or cylinders are formed from finely deposited metals containing a large percentage of hydrogen, such plates or cylinders being caused to retain their form by the application of suitable pressure, thus rendering the use of sustaining plates or supports of any kind within the battery unnecessary. In forming these plates or cylinders, lead solution is the metal preferably employed, as it contains a large quantity of occluded or nascent hydrogen. The lead may be caused to deposit in a finely divided state either by electrolysis or by chemical process. Having thus prepared the lead, it is pressed into any form suitable for use as an element in a secondary battery, which is then charged in the ordinary way. (*Provisional only.*)

2501. "Materials for electrical insulation." B. RHODES and G. BINSWANGER. Dated May 26. 4d. The object of this invention is the production of a good and economical electrical insulating substance by the novel combination for this purpose of asbestos with india-rubber, gutta-percha, and other glutinous substances in the manner hereinafter described. Asbestos—india-rubber and gutta-percha are each separately in use and are well known as insulators in connection with electricity, but their separate use for this purpose is attended with certain disadvantages, such as great cost and want of durability which it is the intention of the present invention to overcome. The combination of the materials hereinafter described, forming the subject of this invention, will combine the essential advantages of being thoroughly efficient as an insulator for electrical purposes and can be produced at a price much less than at which insulating substances employed for a similar purpose are now manufactured. When carrying the invention into practice the inventors proceed as follows:—they take asbestos and caoutchouc or gutta-percha, together with other resinous and glutinous substances, such as shellac, amber, or the like, to which sulphur also may be added when it is desired to vulcanise the compound into a state which will make it suitable for the different objects to which it may be applied as an electrical insulator. Some of these substances are reduced to a fine powder and the whole thoroughly combined by passing it through heated calenders or rollers in a manner similar to that described in the Specification of a Patent granted to the above-named B. Rhodes in the year of our Lord 1879, No. 1334.

2516. "Materials for electric insulation." G. S. PAGE. Dated May 26. 2d. The inventor takes any finely-divided dry organic material, also certain groups or families of mineral substances, including metallic oxides, silicates, phosphates, aluminates, borates, carbonates, sulphur, selenium, or compounds of these sulphides, &c; compounds of tungsten and the like minerals; pseudo carbons, carbon in various forms, and suitably mixes and incorporates all or any of these with certain series of organic substances, obtained from and by the preparation of certain portions of coal tar, coal tar oil, coal tar pitch, mineral oil or shale oil, napthaline, anthracene, pyrine, chrycine, and their homologues and derivatives; from bitumen, natural asphalt, colophony resins, natural gums and resins, mineral wax and hydrocarbons, varieties of gutta perchas and caoutchoucs, camphor in various forms or varieties; cellulose in various forms and combinations, as pyroxyline, &c.; also certain so-called waste organic substances, containing nitrogen in an albumenoid form of combination; tannin and other substances containing tannic or tannogallic acid so called; leather and horn substances, &c.; the said mixtures to be in proportions dependent on the special and distinctive use and employment of the compound. (*Provisional only.*)

CITY NOTES, REPORTS, MEETINGS, &c.

The Anglo-American Brush Electric Light Corporation (Limited).

THE following is the report of the directors for the year ending December 30th, 1882:—Liabilities.—Capital.—The amount under this head has been increased by 700 fully paid-up shares, issued by way of compromise to the American vendors, in settlement of mutual claims on account of Russian and Belgian patents; the granting of the Russian patents having been delayed in Russia for about a year and a half. The paid-up capital was thus increased to £245,006. A further sum of £24,522 was paid up to the 31st December on capital account in advance of the call made for the 1st of January, 1st of February, and 1st of March, 1883. Assets.—Patents and property.—The price at which these stood at the end of 1881 was £204,898 8s. 10d. These figures have in the present report been further subdivided, and they now stand—Patents, 1881, £177,105 16s. 6d.; 1882, £2,360 11s. 3d.; total, £179,466 7s. 9d. Victoria Works, 1881, £20,467; 1882, £11,839 16s. 3d.; total, £32,306 16s. 3d. Borough Road, 1881, £900; 1882, £20,218 6s.; total, £21,118 6s. Portpool Lane, 1881, £3,646; 1882, £9,419 19s. 7d.; total, £13,065 19s. 7d. Grand total, £245,957 9s. 7d., or an increase of £41,089 0s. 9d. The price at which the patents thus stood at the end of the year was represented (irrespective of the amounts arrived at in adjustment of the above mutual claims in respect of the Russian and Belgian patents) by an addition to the figures of the last balance sheet of the above sum of £2,360 11s. 3d. paid for patent charges during the year. The Russian patents are still unsold, and the purchases of the Italian and Scandinavian patents are not completed. There is also an interest of one-third of future profits due to the corporation on account of the French patents. Guided by the experience of 1881, when it was found that the greater part of the business was done during the latter half of the year, it was decided to prepare large stocks in anticipation of the demand which was expected in preparation for the winter months of 1882. Owing, however, to the action of the Electric Lighting Act of 1882, and to other causes, the demand for electrical apparatus received a sudden and severe check, with the result that stocks representing at cost prices £93,034 2s. 3d. remain on hand, causing an increase over last year's stocks of £40,163 8s. 6d. This accumulation of stocks on hand, together with the sum of £41,089 0s. 9d., referred to above as having been spent on plant, buildings, &c., entirely changed the position of the company, and caused the directors much concern during the month of November, and after full discussion they determined on making the call of £3 on the £4 paid shares on the 29th November. Had these causes not thus suddenly arisen to prevent the sale of apparatus, a large profit would have been made upon the above stocks, and a further handsome dividend, in addition to the 100 per cent. already paid, would have been provided, as had been reasonably anticipated. The securities in hand consist of shares in home and foreign companies, representing in value at par £86,200, and bills receivable £5,404 5s. 10d. Balances consist of:—Amount brought forward from 1881, £2,934 18s. 9d.; cash and shares for concessions, &c., 1881, £99,500, cash and shares for concessions, 1882, £307,795 15s. 11d.; total, £407,295 15s. 11d.; profit on manufacturing account, £33,713 0s. 6d., making a total of £443,943 15s. 2d., out of which an *interim* dividend has been paid of £245,006, leaving £198,937 15s. 2d., to which is to be added £50,000, payable in March by Mr. Lane-Fox, making £248,937 15s. 2d. as the undivided amount at credit of profit and loss account for the year. It has been decided to submit for the confirmation of the proprietors the following mode of appropriation of the balance of £248,937 15s. 2d., viz., to write off from the purchase price of patents, patent rights, &c., the sum of £132,950, which sum will be represented in the assets in future by shares in the sub-companies, and to write off 10 per cent. for depreciation of plant and buildings, and leaving a balance to be carried forward to profit and loss account 1883 of £109,338 13s. The directors say they have only to express in conclusion their regret that the extraordinary prosperity which attended their efforts during the early part of the past year has been followed by a temporary reaction towards its close, resulting from circumstances beyond their control. They cannot, however, but believe that when the numerous provisional orders now applied for, both by municipal authorities and by the licensees of the corporation, have been obtained, a fresh impetus will be given to electric lighting generally, and in that event the corporation will naturally command that large share in the business to which the value of their patents, the proved superiority of their apparatus, and their experience and manufacturing facilities so justly entitle them. Major Childs resigned his seat at the board on the 10th October. Lord Claud John Hamilton, M.P., was appointed by the directors to fill up the vacancy on the board created by the resignation of Mr. Nettlefold, who had expressed his intention of retiring at the general meeting of last year, but who consented to remain as long as his personal business would permit, and Lord Claud John Hamilton's name will be submitted for confirmation as a director at the meeting. The directors retiring by rotation are Mr. Courtenay, Mr. Ladd, and Mr. Sellon, who are eligible and offer themselves for re-election. The auditor, Mr. A. E. Jarvis, also retires, and offers himself for re-election.

The liabilities consist of—capital, £269,528; accounts, £86,352 3s. 1d., and the balances £248,937 15s. 2d.; total, £604,817 18s. 3d.; and the assets—patents, £179,466 7s. 9d.; property, £66,491 1s. 10d.; stocks, £93,034 2s. 3d.; accounts, £153,634 8s. 0d.; securities and bills, £91,604 5s. 10d., and cash, £20,587 12s. 7d.—total £604,817 18s. 3d. Added to the report are the following statistics:—

Statement showing amount realised from sales of concessions and patents, 1881 and 1882.

		CASH.	SHARES.	TOTAL.
		£ s. d.	£	£ s. d.
Dublin Electric Light Co.... ...	1881	1,000 0 0	9,000	10,000 0 0
Hammond Co. (Durham Cumberland)	1881	10,500 0 0	...	10,500 0 0
Hammond Co. (Yorks and Derbyshire)	1881	7,500 0 0	...	7,500 0 0
Hammond Co. (Hants and Sussex)..	1881	2,500 0 0	...	2,500 0 0
Scottish Brush Electric Light and Power Co. (Limited) ...	1881	10,000 0 0	20,000	30,000 0 0
Blaine, Macdonald and Co. (South Africa)	1881	6,000 0 0	...	6,000 0 0
Crédit Lyonnaise...	1881	10,000 0 0	...	10,000 0 0
Eastern Electric Light and Power Co. (Limited)	1881	18,000 0 0	20,000	38,000 0 0
		65,500 0 0	49,000	114,500 0 0
Less expenses incurred	1881	15,000 0 0	...	15,000 0 0
Carried to reserve, 31st December, 1881	...	50,500 0 0	49,000	99,500 0 0
Hammond Co. (Westminster) ...	1882	1,000 0 0	...	1,000 0 0
Great Western Electric Light Co....	1882	13,750 0 0	15,000	28,750 0 0
South-Eastern Brush Electric Light and Power Co.	1882	10,000 0 0	...	10,000 0 0
Brush Midland Electric Light and Power Co.	1882	14,000 0 0	16,000	30,000 0 0
Hammond Co. (Warwick and Worcester)...	1882	6,000 0 0	...	6,000 0 0
Metropolitan Brush Electric Light and Power Co.	1882	150,000 0 0	...	150,000 0 0
Provincial Brush Electric Light and Power Co.	1882	25,000 0 0	...	25,000 0 0
Anglo-Spanish Electrical Co. ...	1882	4,000 0 0	36,000	40,000 0 0
Australasian Co.	1882	31,005 0 0	...	31,005 0 0
M. Frankel (Deposit France) ...	1882	1,000 0 0	...	1,000 0 0
Anglo-Austrian Co.	1882	16,000 0 0	28,000	44,000 0 0
Paid on Irish licence	1882	2,000 0 0	...	2,000 0 0
Paid on Isle of Man	1882	250 0 0	...	250 0 0
South African Co. (Natal) ...	1882	500 0 0	...	500 0 0
Paid on Scandinavian patents...	1882	4,000 0 0	...	4,000 0 0
" Italian do. ...	1882	5,000 0 0	...	5,000 0 0
" Belgian do. ...	1882	1,000 0 0	...	1,000 0 0
		335,005 0 0	144,000	479,005 0 0
Less amount in account with Mr. Fox, in respect of Lane-Fox patents	...	13,680 0 0	...	13,680 0 0
		321,325 0 0	144,000	465,325 0 0
Less commission, charges, salaries, fees, &c.	1882	58,029 4 1	...	58,029 4 1
		£263,295 15 11	144,000	407,295 15 11

Statement of share certificates held by the corporation:—

	£ s. d.	£ s. d.
Anglo-Austrian Company	£28,000 0 0	
Scottish Company	13,250 0 0	
Midland Company	15,950 0 0	
Dublin Company	9,000 0 0	
Eastern Company	20,000 0 0	
		86,200 0 0

Statement of share certificates to be received by the corporation:—

Great Western Company	10,750 0 0	
Anglo-Spanish Company	36,000 0 0	
		46,750 0 0
Shares sold by the corporation		11,050 0 0
		£144,000 0 0

Statement of patents yet unsold or purchases not yet completed:—

Belgium. Italy. Russia. Scandinavia.

The list of expenses, commissions, charges, &c., for the year 1882 amounts to £102,832 2s. 4d., of which £58,029 4s. 1d. is debited to sales of concessions, and the balance, £44,802 18s. 3d., is charged to manufacturing account in the general balance sheet.

The ordinary general meeting of the corporation for the year 1883 will be held at the Cannon Street Hotel, on Tuesday next, at two o'clock in the afternoon, for the purpose of transacting the ordinary business of the company in general meeting, and as special business, to pass a resolution to enable a further issue of 700 shares of £10 each, fully paid up, to Mr. Charles Francis Brush, or his nominees, in compromise of the agreements for the purchase of the Russian and Belgian patents, to be officially quoted on the Stock Exchange, such shares being numbered 40,001 to 40,700, both inclusive.

The following letter, to the editor, appeared in the *Daily News* of Wednesday last:—

Sir,—I desire to warn fellow-shareholders that the report and accounts issued by the board of the Anglo-American Brush Electric Light Corporation (Limited) represent the affairs of the company as regards important transactions with myself and others in a light which is altogether misleading to the proprietors. The report is also, in my opinion, calculated to convey very false impressions as to the present and future position of electric lighting in regard to the company. It is my intention, therefore, at the general meeting which has been convened for the 23rd instant to move that a committee of shareholders be appointed; and that the consideration of the report and accounts be deferred until the proceedings of the board, the accounts of the company, as well as the policy which is being pursued, have been investigated and reported on by this committee. I strongly recommend shareholders not to send in the proxies issued by the secretary, but either to attend the meeting personally, and hear the matters I propose to bring forward discussed, or to give their proxies to independent shareholders, who could attend the meeting for the purpose. I may add that I am thoroughly convinced that should the shareholders decide to allow the continuance of the present policy of the board it must lead to disaster at an early date.—I am, sir, your obedient servant, ST. G. LANE-FOX. 39A, Threadneedle Street, E.C., January 16th. P.S.—If any shareholder should have sent a proxy to the directors, he can recall it by letter.

The Phœnix Electric Light and Power Company (Limited).

[The following is the circular alluded to by Mr. Dunlop in our Correspondence columns for this week.—EDS. ELEC. REV.]

4, George Street, Hanover Square, London, W.
15th January, 1883.

To the shareholders of the Phœnix Electric Light and Power Company (Limited).—Gentlemen,—The directors have had their attention called by the secretary to a circular dated the 10th inst., bearing the names of Mr. R. Hough and Mr. C. P. Whiteley, and addressed to the shareholders of this company, purporting to give you the result of the adjourned meeting, and seeking your support. The directors being shareholders have not, however, had a copy of such circular sent to them, and you will be able to draw your own conclusions at this attempt in circularising you behind their backs with so-called "curious facts disclosed," to obtain your support by misleading statements. The directors have now to state to you that accompanying the prospectus of the company when it was issued was a full copy of Prof. Varley's report, and the words which are quoted by Messrs. Hough and Whiteley, instead of being a suppression or a qualification of his report materially enhance its value, for Prof. Varley distinctly states that *although he had not had the opportunity of submitting the lamp to a test of long duration*, yet, *without that test*, he was of opinion that it was *superior* to all existing incandescent lamps. Prof. Varley's report is now placed before you again *in extenso*.

2, Great Winchester Street, London, E.C.
10th May, 1882.

THE NEW ELECTRIC LAMP
(Fitzgerald's Patent).

I have examined the invention, and the mode of its construction. I have not had the opportunity of submitting it to a test of long duration; but, in my opinion, it is superior to all existing incandescent lamps, and I think it will prove more durable than any now known. C. F. VARLEY.

You will see then that Messrs. Hough and Whiteley, while charging the directors, without the least foundation, with suppressing a portion of Prof. Varley's report, are themselves the ones now suppressing a most material portion of it. The directors can only regret that Messrs. Hough and Whiteley should seek thus to damage the value of the lamp, when the money to be recovered back from the vendor, Mr. Jones, of the School of Electricity and Telegraphic Engineering, of 12, Princes Street, Hanover Square, forms the material asset of the company. The directors, at the statutory meeting held on the 4th September last, explained fully then the difficulties which had arisen in placing concessions; and they state again that at the commencement of the company they had every belief in the *bona fides* of the proposals placed before them, so much so that some of them increased their holdings of shares. The five directors hold 1,610 shares, which they have paid up in full. The third proposal reached them after the issue of the prospectus, and considerably strengthened their faith in the ultimate success of affairs. Negotiations for districts have been continually in hand, but the want of public confidence in all matters connected with the future of electricity has prevented the board from obtaining a closing concession, and it is the failure to place a concession, which was in treaty up to the middle of November, which caused Mr. Jones to break off his arrangements with the board (subject to the rights of the company) and compelled the directors, in the interests of the whole body of shareholders, to at once bring before you the necessity of voluntarily winding-up. The misunderstanding with Messrs. Foster, Hight & Co., in July, occurred in regard to a payment to them, which, as the directors were advised, they had reasonable grounds to withhold. It was submitted to counsel, who was of opinion that it could not be withheld, and Messrs. Foster, Hight & Co. having presented a petition, the claim had to be settled. The facts were generally known at the time and formed the subject of inquiries from shareholders, prior to the statutory meeting, which were fully answered.

The directors in replying to the three paragraphs in regard to the voting and poll, and which contain flagrant mis-statements, have to advise you that the meeting consisted of thirty-seven shareholders, including themselves. On the show of hands on the amendment twenty-six were counted for and seven against, but on the poll, afterwards duly taken, it was discovered that a large majority of those who had held up their hands in favour of the amendment had no right to vote, being disqualified for non-payment of calls. The result of the poll was as follows—against the amendment, 48 shareholders having 4,419 votes; for the amendment, 10 shareholders having 750 votes, giving against the amendment a majority of 3,669 votes. The amendment being thus negatived, the original resolution was duly put and carried by votes of over three-fourths of the shareholders then present and entitled to vote. Had it been necessary to take a second poll the resolution would no doubt have been carried by even a larger majority of votes than those by which the amendment had been negatived. The directors simply desire to place before you these plain facts, leaving them to speak for themselves, so that you may not be misled by mis-statements. It has been plainly put forward by the petitioners that they desire to get an accountant of their own nomination appointed as liquidator, while they state that the directors wish to liquidate the affairs themselves. The directors desire to say that they have never suggested, and do not suggest, this latter course. They propose voluntary liquidation as the cheapest and most expeditious plan to adopt for all concerned, and it will then rest entirely with the shareholders thereunder to appoint their own liquidator. In these circumstances the directors sincerely trust for a continuance of your support at the meeting on the 23rd inst., so as to enable them to defeat the attempt to waste all the assets of the company in a Chancery winding-up.

By order of the board,
WALTER DUNLOP, *Secretary*.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid	Closing Quotations. Jan. 17.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	5	6 - 6¼	6⅛.⅛.⅜.7⁄8.3⁄4.6
		Do. Do.	10	10 - 12	12¼.11⅞
30,000	5	Australasian Electric Light, Power & Storage Co.	3	⅛ - 1	
24,900	10	British Insulite Co., Limited, "A" Shares	5	2 - 3	
30,000	5	Brush Electric Light & Power Co. (Scotland)	2½	¼ - ¾	
25,000	5	Great Western Electric Light & Power Co.	2½	¼ - ¾	
24,980	5	Hammond Electric Light & Power Supply Co.	2½	2½ - 3	
40,000	5	Indian & Oriental Electrical Storage Works Co.	2	¾ - 1¼	
172,500	1	Maxim-Weston Electric Light and Power Co.	1	..	
49,000	5	Pilsen-Joel & General Electric Light Co.	2	1 - 1½	
..	..	South African Brush Electric Light & Power Co.	2½	¾ - 1¼	
100,000	5	Swan United Electric Light Co., Limited	2½	2½ - 2¾	2½.⅞
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	50 - 51	50½.50
2,441,300*l.*	Stk.	Do. Preferred Def'd. receiving no div. until	100	82- 83	82½
2,441,800*l.*	Stk.	Do. Deferred 6 p. c. has been paid to Pref.	100	18½- 19½	19½.18⅝.19
130,000	10	Brazilian Submarine, Limited	10	11⅞- 12½	11⅞.12.11⅞
16,000	10	Cuba, Limited	10	10 - 10½	
6,000	10	Do. 10 per cent. Preference	10	17 - 18	
13,000	10	Direct Spanish, Limited	9	6½- 7	
6,000	10	Do. 10 per cent. Preference	10	16 - 17	
65,000	20	Direct United States Cable, Limited, 1877	20	12½- 12⅝	
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	100 -103	
380,000	10	Eastern, Limited	10	10⅞-11¼	11.¼ xd.
70,000	10	Do. 6 per cent. Preference	10	13 - 13½	13⅜ xd.
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	100 -103	103¼
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	102 -105	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	105 -108	
199,750	10	Eastern Extension, Australasia & China, Limited	10	11⅞- 12⅛	11⅞.⅝.12 xd
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	103	109 -112	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	104 -107	
140,000	100	Do. do. registered, repayable 1900	100	104 -107	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	102 -105	
254,300*l.*	100	Eastern and South African Limited 5 per cent. Mort. Deb. Registered redeemable 1 Jan. 1900	100	103 -106	
345,700*l.*	100	Do. do. do. To Bearer	100	103 -106	
22,050	10	German Union Telegraph and Trust, Limited	10	10½- 10⅞	10½
163,390	10	Globe Telegraph and Trust, Limited	10	6⅜- 6⅝	6⅜ xd.
163,209	10	Do. 6 per cent. Preference	10	12⅜- 12⅝	12⅜
125,000	10	Great Northern	10	12 -12½	12
100,000*l.*	100	Do. 5 per cent. Debentures	100	100 -103	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	29 - 30	29½.½.½
100,000	100	Do. 6 per cent. Debentures, 1886	100	100 -103	
17,000	25	Indo-European, Limited	25	32 - 33	
38,148	10	London Platino-Brazilian, Limited	10	4 - 4½	
12,000	10	Mediterranean Extension, Limited	10	1½- 2	
8,200	10	Do. 8 per cent. Preference	10	6 - 8	
9,000	8	Reuter's, Limited	8	12 - 12½	
280,000	Stk.	Submarine	100	252 -257	
58,225	1	Do. Scrip	1	2⅜- 2⅝	
4,200	Cert.	Submarine Cables Trust	100	105 -109	103
37,350	12	Telegraph Construction and Maintenance	12	32½- 33¼	33¼
150,000	100	Do. 6 per cent. Bonds, 1884	100	100 -103	
186,750	5	Do. 2nd Bonus Trust Cert.	5	1½- 1⅝	
30,000	10	West Coast of America, Limited	10	4½- 5½	
150,000	100	Do. 8 per cent. Debentures	..	.. - ..	
69,910	20	Western and Brazilian, Limited	20	7⅛- 7⅜	7⅛.¼
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	104 -107	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80, red. Feb., 1910	100	98 -101	
1,500	$1,000	Western Union of U. S. 7 p.c. 1 Mort. (Building) Bds.	$1,000	122 -126	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	102 -105	
88,321	10	West India and Panama, Limited	10	1⅛- 1⅜	1⅜
34,563	10	Do. 6 per cent. 1st Preference	10	7 - 7⅛	
4,669	10	Do. 6 do. 2nd do.	10	5½- 6	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	⅜- ½	½
200,000	1	Oriental Telephone Co., Nos. 100,000 to 300,000	¼	⅜- ½	⅜.½
100,000	5	United Telephone Co.	5	10½- 11¼	11¼